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December 10, 1931

Unemployment Relief by Winter Road Work

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Also

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New Concrete Pier Built On Seattle Waterfront

Composition of Earth Dams Discussion—Part IV

Infiltration Tests on New Jersey Outfall Sewer

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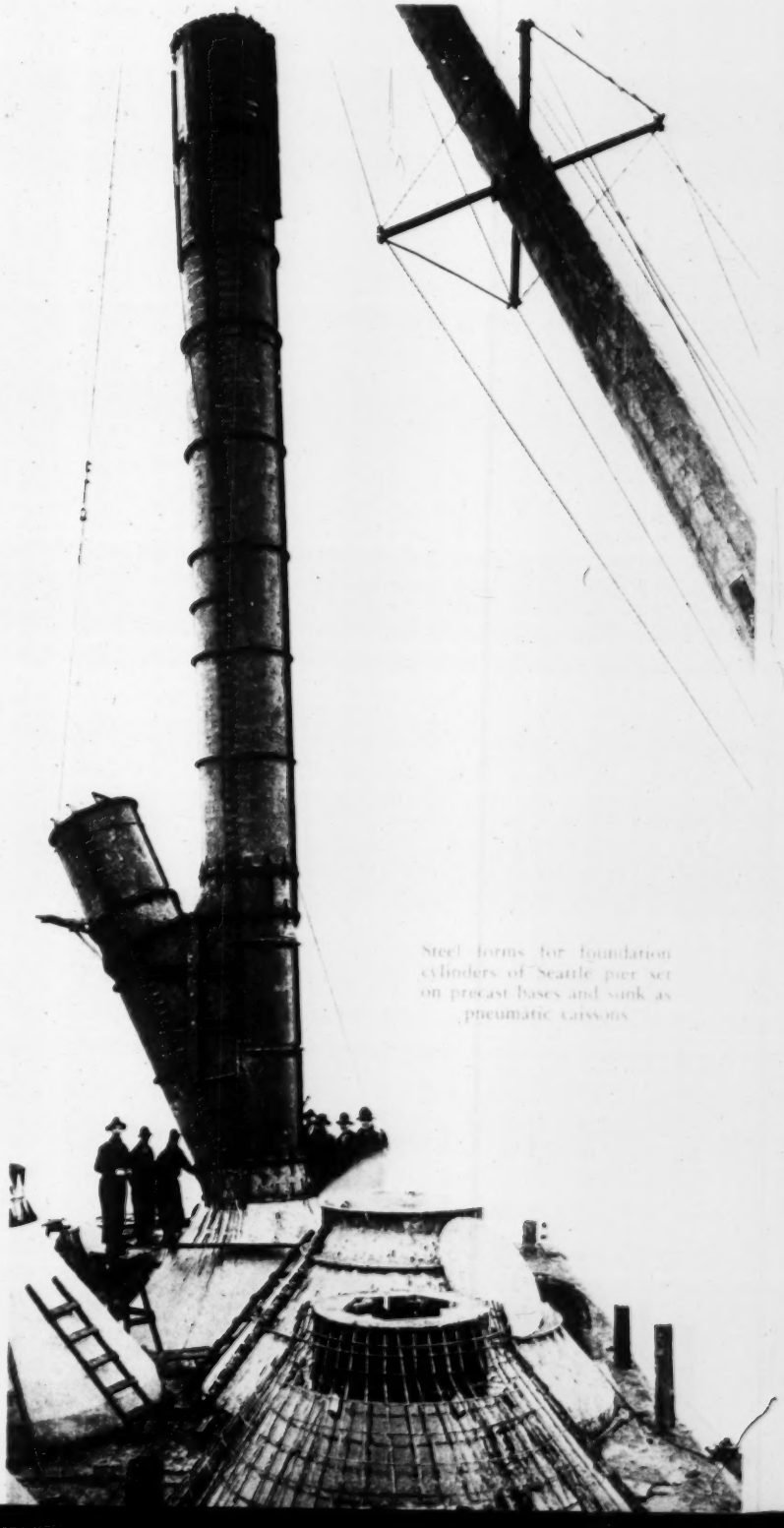

Steel forms for foundation cylinders of Seattle pier set on precast bases and sunk as pneumatic caissons

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ENGINEERING NEWS-RECORD

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F. E. Schmitt, Editor

DECEMBER 10, 1931

Sensational Charges

THE sensational charges made by William Green of the American Federation of Labor against contractors on the Mississippi flood-control work call for immediate impartial investigation. Mr. Green charges atrocious brutality and high-handed exploitation of men working along the river. Such indictment, supplementing other charges of long working hours and pay so low as to be practically all absorbed in commissary bills, may not be permitted to stand unchallenged. The good repute of the river contractors and of the Engineer Corps is at stake. We confidently believe that investigation will overthrow the charges. Isolated cases of ruthless exploitation may perhaps be found, but that the Corps of Engineers would permit any such general condition to develop is inconceivable. Belief is not enough in such an issue, however; the charges must be answered by full and precise fact.

Work Well Begun

A PROMISING start has been made by the new Construction League. The detail organization and plans as worked out last week by its policy committee conform closely to the principle on which it was founded —namely, that the league shall serve as a means of mutual support in matters of industrywide interest without infringing on the individual field of a member body. Enough subjects of joint interest have already appeared to justify its formation; without the league they would have been unlikely to enlist general support and might even have escaped study. Several movements or reforms that are being promoted by members were indorsed as meriting the approval of the whole industry; other subjects were referred to the league's working committees for study, as a basis of possible recommendations to member bodies. Regardless of the importance of these specific subjects, their study will develop a construction-industry viewpoint, and that is what the present time needs. When all problems of construction are considered from this viewpoint, and yet with fairness to all parties involved, many of the present difficulties that beset the construction art will disappear.

An Efficient Monitor

ONCE again the United States Supreme Court has played the part of an efficient monitor, standing against municipal misbehavior that injures the citizens of another state. It has affirmed the master's finding in the complaint of New Jersey against the dumping of garbage at sea by New York City, a practice proved to be a nuisance and a source of beach pollution. Also following the master's recommendation, the court has given the city something more than a year to provide other disposal facilities. Accordingly, by the middle of 1933 the only important example of garbage disposal at sea will be a thing of the past. New York's action to take care of its garbage by other means will have to be prompt and efficient, but the stipulation can be met without hardship. Indirectly it will benefit the inhabitants of the city itself, since it will virtually compel the adoption of the most efficient methods available for collection and disposal. Moreover, the court's requirements of quarterly reports by the city on its progress in providing garbage disposal is likely to strengthen the hands of the responsible technical officials who must carry out the program; if they are to live up to the time schedule set, they must be unhampered in planning and building the best facilities at the command of the art.

Tardy Help

INCREASES in rates on specific commodities and carload lots have been granted the railroads by the Interstate Commerce Commission. Income from the increase is to be segregated and used to create a fund from which loans will be made to railroads in distress. The commission's plan for direct gifts—strongly opposed by the railroads—is abandoned, but the commission washes its hands of responsibility for the loan plan and the machinery to be set up to administer it, for lack of authority over a fund so created. Thus, after needless months of waiting, the railroads get not what they said last June they needed but a modified form of what the commission in its assumed superior knowledge of their real needs thought they should have. Whether relief comes in time to save many railroads from the hands of receivers remains to be seen. For the Wabash, at least, it came too late.

Superdirectors

IN THIS day, when most industrial groups are considering closer cooperation than is now permitted by law, a survey of what the Interstate Commerce Commission has done—or has failed to do—in the freight-rate increase case is anything but encouraging. All present plans for closer cooperation within any industry are predicated on governmental supervision. The transportation act of ten years ago conferred just such responsibility upon the commerce commission, after giving the railroads broader rights than they would otherwise have had under the anti-trust acts. The commission was charged with the responsibility of seeing that the railroads did not abuse these privileges and yet that the restrictions of the act did not become too oppressive to them. The act did not contemplate setting up the commission as a body to run the railroads, yet the record of

the past ten years indicates a growing tendency upon the part of the commissioners to assume the rôle of superdirectors, and inefficient superdirectors at that. The recent rate case is the most striking example of this. The railroads asked for a flat increase of 15 per cent in freight rates. That amount, in the judgment of their operating officials, was necessary to keep them in sound operating condition, and indeed solvent. The commissioners, after a delay that would have been inexcusable in real executives and was seriously harmful, concluded that the increase would do the railroads more harm than good and so denied the request, substituting a plan of their own devising, a plan, be it noted, of doubtful legality. In so doing the commissioners denied the right of railroad directors to determine how best to operate the properties intrusted to them. The commissioners in effect appointed themselves superdirectors of the railroads of the country. Can a like body controlling the destinies of some other industry be expected to do better? That thought should cause those who contemplate putting their industry under regulatory supervision to reconsider their plans. In the light of the Interstate Commerce Commission's failure to help the railroads through a period of depression, few industries will voluntarily submit to such control. The cure may be worse than the disease.

Bidding for Jobs

HOW can engineers expect to be treated as professional men while they continue to rate their service as a commodity? Consider what occurred recently in Tama County, Iowa. Nine engineers sought the position of county highway engineer. The average Iowa county engineer's salary is 1.3 per cent of the total county highway expenditures, and on this basis the county in question should pay $4,000 per year. But the various "bidders" offered to take the work at anywhere from $1,200 to $2,800 per year. The Iowa Engineering Society, which since the days of the late John Dunlap has worked to enhance the status of the engineer, has seen to it that the state is provided with a good license law; but only four of the Tama County "bidders" were registered under this law, and not a single one of the nine was a member of the society. These are conditions worth pondering. The bare facts of the competition, however, give anew the clear warning that so long as engineers permit city councils, county boards and other employers of engineers to "buy" engineering services as they buy sand or gravel, engineering service will be treated as a commodity.

Possibilities in Reconditioning

ONE of the committees of last week's home-building conference dealt with the possibilities of reconditioning houses, a timely matter in view of the low prices now prevailing. Though the subject may not be particularly appropriate to the general theme of housebuilding, it merits attention on its own account. As the committee brought out, both repair to make good wear and tear and modernization to make good obsolescence are economical means of saving loss of value. Until money becomes easier and demand for realty livelier, a dollar well applied to reconditioning may accomplish what would require several dollars spent in new building, and therefore can profitably supply a lower-priced demand. Many recognized this fact months ago, as shown by such items as the well-maintained market for paint during recent months. But it deserves even wider recognition, for immediate attention to all reconditioning possibilities will be of double value: it will take advantage of profitable prices, and it will also create employment.

Proper Perspective

GET your facts before you begin to solve your problem! This fundamental rule of engineering procedure was helpfully recalled by Prof. Charles M. Allen in speaking before the hydraulic division of the American Society of Mechanical Engineers a few days ago. Never in his long experience in research work, said Prof. Allen, has he seen even the most involved mathematical analysis produce correct results when the basic assumptions were inaccurate. Many a man can confirm this statement from his own experience, yet everyone may profitably take new note of it. Prof. Allen was speaking of the factors affecting piezometer readings, but all work is subject to the same rule—structural, hydraulic, traffic or other. Too often one sees mathematical refinement carried to the last degree in the derivation of a formula whose underlying laws are known only in roughest approximation. Too easily the engineer gets so close to his problem that he loses sight of the limitations affecting the basic assumptions. Proper perspective is essential in scientific and engineering studies as in other things of life.

Pioneer Work

ONE-FOURTH of the country's annual construction bill goes to the account of housebuilding. An industry that invests several billion dollars each year has a quite obvious importance to engineering and to the entire field of construction. Therefore it is of vital concern to know whether housebuilding is sound or otherwise. Especially in times like the present, when the industry seems to suffer from pernicious anemia, we have good reason to ask about its condition.

Some important facts bearing on this question were brought out last week at the President's Conference on Home Building. They are facts that very likely everyone should have known, but probably few do know; at all events they are quite certain to receive careful study in future. The conference, which proved to be a remarkably comprehensive reconnaissance of housing conditions and problems, showed clearly that a vast amount of pioneer work needs to be done before housebuilding can be placed on a sound basis. The situation in fact is such as to confront the industry with problems of utmost seriousness.

Two findings of the conference bring out the vital point of the situation in most convincing form: *first*, it was determined that the present building art is unable to provide acceptable houses for the family whose income is limited to $1,500 or less; and *second*, the average wage or salary income of employed city workers, more than thirty million people, is below $1,500 even in good times (1927) and unquestionably is much lower in bad times or in the long run. These facts seem to mean that the building art has made a pretty thorough failure of its job. Precisely that kind of housing which is most needed—housing for the wage-earner—cannot be supplied at a price which the consumer can afford. In very cautious words one committee of the conference

put the matter thus: "While home ownership is desirable and should be encouraged, it may not be practicable to provide under present conditions satisfactory new homes for the lowest wage-earning group"—or, it might have added, for the average wage-earning group.

This situation obviously constitutes a very direct challenge. But it has little direct meaning unless we go back of the facts just stated and discover the reasons or causes. Fortunately the conference brought these out fairly well, though in a chaotic tangle—buried in several dozen verbose and rambling committee reports which no central authority had taken the trouble to harmonize and correlate.

From these reports it becomes clear that design, construction, promotion, financing and merchandising of houses all are at fault, probably in roughly equal shares. Looking at the kinds of men affected, we see that the architect shares in responsibility with the builder, the development planner with the realty man, and the moneylender with the building craftsman. All of these contribute to making houses imperfect and unsatisfactory in their convenience and amenities, short-lived, high in maintenance cost, and, above all, far too high in price.

Very definite blame rests on the technical group and on the building arts: on designer and builder, and on the industries which produce building material and home equipment. Blame must also be placed upon community control (or rather absence of control), which permits or encourages the planning and construction of unsocial house developments, fails to limit congestion, and does little or nothing to assure good construction. Urban transportation must also be charged with responsibility, for in the larger centers it has made an utter failure of its attempt to provide tolerable mass transportation to home areas.

But in so far as costs are the crucial difficulty of the housebuilding situation, finance is most of all to blame. The traditional doctrine of six per cent primary mortgage loans, and of still more costly secondary loans, coupled with the utterly unorganized condition of house financing and selling, make the real estate field often seem more nearly a racket than a business. That nothing has been done to provide liquidity of either real estate securities or real estate itself is even more injurious, though perhaps only a sequel of the causes indicated.

In this welter of bad conditions it is easy to single out secondary details for main attack, but it is hardly appropriate. Taxation was severely blamed at the Washington conference; the 2½ per cent or so of real property taxation was described—and this by leading economists—as a crushing burden. Yet when compared with the burden of excessive mortgage interest it is plainly a small item.

Reform of housebuilding will evidently not be an easy or a short undertaking. It is a pioneer task calling for energy, knowledge and skill on the part of the many interests concerned in the field. The projected continuance of the work of the home building conference promises to give these interests effective opportunity for cooperation. With wise direction this future work can be made to yield large dividends. In the meantime, however, it is plain that the technical agencies concerned in housebuilding have an independent responsibility. They need not wait for the cooperation of other interests to analyze their own shortcomings and work out remedies. Planning, design and construction can reform their own practices without waiting on the sociologist and the moneylender.

Unemployment Relief by Winter Roadbuilding

THE winter highway work described in a group of leading articles in this issue is a notable response by highway departments to the call for employment. For the two normal working seasons of the present business depression these public-works agencies have led all others in unemployment relief by construction. Last summer they gave work directly to a third of a million men, and this, when carried back to the labor in factory, pit and quarry, means a total of three to five times this figure. No other public work has been so widely distributed or has provided so great an opportunity for common labor. And now it is showing an unexpected ability to reach out beyond its normal working season to possibilities that command engineering attention even aside from the immediate purpose of helping idle men to obtain work. Its advantages at a time like this when any kind of construction work is desirable are obvious; its possibilities in normal times warrant further study by all interested in stabilizing construction.

The plans of winter operations in Ohio, Michigan, New Jersey and other states are proving the practicability of year-round activity in a class of construction commonly regarded as unchangeably seasonal. If the fact that road work is a twelve months' possibility can be established and brought to wide recognition, and if it then can be carried into general practice, it will do much to regularize a yearly unemployment situation whose cumulative total of idleness is large. No other field of construction shows so great a range between peaks of summer activity and winter idleness. Equipment, materials and labor markets rise and fall with construction activity.

As worked out to meet the present emergency the plans described naturally present characteristics incongruous with normal construction practice. The Michigan plan of requiring hand labor in virtually every construction operation is obviously justified only through the abnormal unemployment conditions of the moment. Even in these conditions it is questionable whether forcing hand labor into operations which machines can perform more economically extends employment as far as would adherence to normal construction methods. The men who shovel dirt by repeated lifts out of a foundation pit get employment, but the men who would have produced an excavating machine that would perform the work at less cost in a fraction of the time are deprived of work—and this chain extends all the way back to the last laborer who digs the ore out of the hills.

Construction but poorly meets its obligations toward unemployment relief when it reverts to practices of past ages. Engineering skill is shown not in merely employing labor but in employing it without discarding the benefits of ingenuity and inventive genius expressed in modern machinery. So long as this truth is held fast, emergency reversion to hand labor may not justly be condemned altogether. It may, as is the case in Michigan, be the only practicable relief from dole payment. And especially if, as in that state, those kinds of work are selected which call largely for manual labor the objective of creating maximum employment is gained without casting away technical advances in construction methods. The present articles command particular attention because of their clear demonstration of this fact.

Construction of the First Concrete Pier on the Seattle Waterfront

Live loads for pier and shed aggregating 1,800 lb. per sq.ft. dictate concrete supporting columns in place of usual timber piles—Cylindrical steel forms sunk by pneumatic process, filled in the dry and carry 800 tons

By W. F. WAY
Chief Engineer, Henry & McFee Contracting Co.
Seattle, Wash.

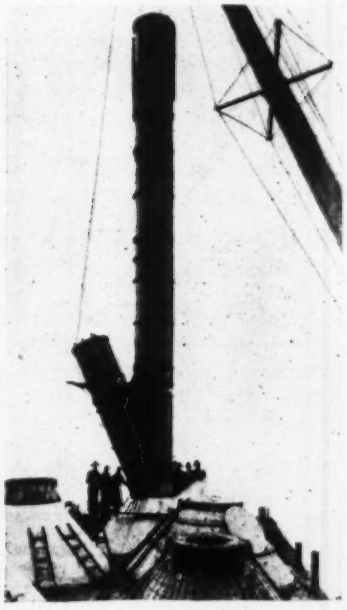


Fig. 2—Form for supporting cylinder, with diagonal brace stub, ready to be lowered

After placing, the water-ballast tank and airlocks were set on top. Note precast column bases in foreground.

DEPARTING from the established timber-pile type of pier construction on the Seattle waterfront, the new American Can Co. pier is supported on 4½-ft.-diameter concrete cylinders because of the extremely heavy loading requirements. These cylindrical supports were poured in the dry in steel forms sunk into gravel foundation by the pneumatic process. They carry a reinforced-concrete deck of beam and girder construction 504 ft. long and 160 ft. wide, and a three-story transit shed, which imposes a total designed load of 800 tons per cylinder. The structure has a railroad track along one side and provisions for future widening along the other. One of the interesting construction features was the provision of brace cylinders for additional stiffness.

Typical waterfront construction in Seattle harbor consists of creosoted-fir piling substructure. Such construction, influenced by availability of material and resulting low cost, usually is designed to carry a live load of about 400 lb. per sq.ft. on the main deck and 150 lb. on the upper floor of a two-story transit shed. Substructure of such design costs approximately $1.75 per square foot and has a life of fifteen to twenty years.

The specifications for the American Can terminal provided for a 1,000 lb. per sq.ft. load of tin plate on the main deck, and a three-story fireproof transit shed designed for a live load of 400 lb. per sq.ft. on both floors. The use of creosoted-fir piling for such a structure was out of the question. It would be impossible to drive sufficient piles to carry the load and inadvisable to place the piling under this type of shed because of replacement difficulties. Preliminary designs for concrete construction considered the use of concrete piling, but the results were unsatisfactory because the spacing would be too close for good practice. Also, foundation conditions indicated that the outboard end would not provide penetration sufficient for good construction.

The next type of design studied was one similar to the pier constructed by the navy department at Bremerton, Wash. (*ENR*, March 13, 1924, p. 436), including supports of precast concrete shells with monolithic cores. The type of design finally adopted (Fig. 1), a modification of the Bremerton pier design, provides monolithic concrete cylinders on 24-ft. centers in both directions, with deck construction of beam and girder type. Consideration of flat-slab construction, using a 19½-in. slab on 26 x26-ft. square panels, provided an economic design but was not selected because of lack of lateral stiffness. Reinforced-concrete pier construction on the Pacific Coast indicates cost figures varying from $4.50 to $14 per square foot. The cost of the present pier is near the lower limit.

Particular study was given to the possibility of deterioration of the concrete in sea water. The Bremerton pier has supporting cylinders consisting of a 6-in. precast shell

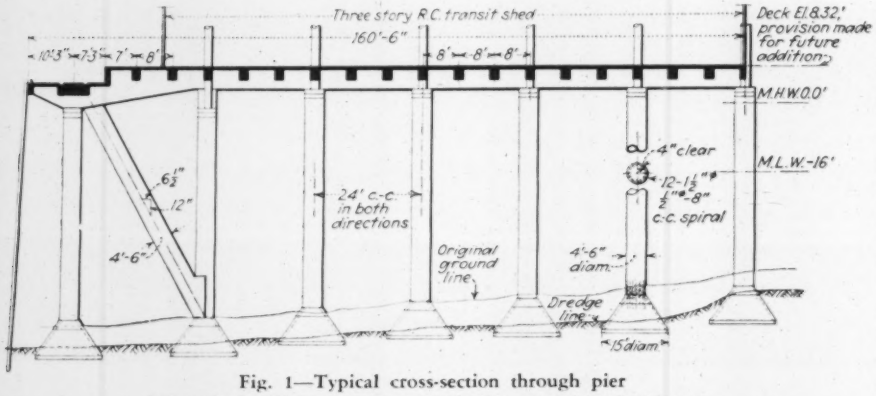


Fig. 1—Typical cross-section through pier

The diagonal brace is not typical; five were introduced near the outer end of the pier to provide additional stiffness.

inclosing a monolithic concrete core, which permits a cover of 2½ in. over the reinforcing. The oldest of these piers has now been in use for ten years and has not shown any sign of distress. To improve on the feature of steel protection, however, it was decided to build the cylinder as a monolith and to provide a 4-in. cover for the reinforcing steel. Also, the cement content for the structure was increased to 1.73 bbl. of cement per cubic yard as an additional factor of impermeability.

Live-load requirements, aggregating 1,800 lb. per sq.ft. when combined with dead load, provided a total load of 800 tons on each supporting cylinder. This was distributed by a bell bottom to place a load of 4½ tons per sq.ft. on the foundation material. Unit stresses in the cylinder concrete were taken at 675 lb., assuming a test strength of 3,000 lb. in 28 days. A high-carbon reinforcing steel was used with a unit stress limit of 20,000 lb. per sq.in.

Foundation material underlying the site varied from hardpan to sand and sand and gravel. The hardpan, however, was in lenses only a few feet thick, underlain by sand and gravel. The site was dredged to remove all loose material and foreign obstructions to facilitate sinking of the foundation cylinders.

The hollow cylindrical pier bases were precast with 6-in. walls, and a 1:1:2 concrete mix was used. They were 5 ft. 9 in. high, 15 ft. in diameter at the base, and 4 ft. 6 in. in the clear at the top. On top of these base sections (Fig. 2) the semicircular sections of cylindrical steel forms were fastened by means of anchor bolts. After the forms were bolted and the joints calked, the entire assembly was picked up by floating derrick and lowered into position. The form was then plumbed and secured in position by suitable temporary bracing.

The reinforcing steel for these columns was made up in one continuous cage and lowered inside the steel shell. Next, an 80-ton water-ballast tank surrounding an airlock was bolted to the top of the form. Compressed air was then applied and the water forced out of the shell. Sandhogs entered and blocked the reinforcing steel 4 in. away from the shell with concrete spacer blocks and mucked the cylinder down from 4 to 8 ft. to firm foundation. The longest cylinder has an unsupported length of 65 ft. 4 in. from top of base to soffit of the crossgirder.

Although the site had been dredged, a number of obstructions at the inboard end were encountered. For the most part these consisted of old pieces of piling and blocks of concrete. Various methods were resorted to for handling each particular case; often light shooting proved most effective and did not damage the caissons. In one case a block of concrete 8x4x2 ft. found directly underneath the cutting edge was drilled and broken up with eight sticks of 40 per cent dynamite.

One of the major construction problems was the concreting of the cylinders, especially those of longer length. The concrete was locked through at the top and allowed to fall the full height of the cylinder. Four sandhogs were needed inside the caisson during concreting operations to operate the inside lock gates and puddle the concrete around the reinforcing cage. Because of the uplift force produced by the sloping sides of the base it was necessary to allow the concrete in the base to take a preliminary set before beginning to place the concrete in the shaft.

In one instance, after the base had been filled and 10 ft. of concrete poured in the shaft, the entire form (including 56 tons of water ballast) suddenly raised 4½ in. In raising, the blocking between the cylinder forms and the bracing system, which held the form in proper position, was dislodged. This permitted the form to settle back about 18 in. out of plumb. Sufficient concrete escaped from under the cutting edge to lower the surface of the concrete to the top of the precast base, which later proved to be helpful in remedying the situation.

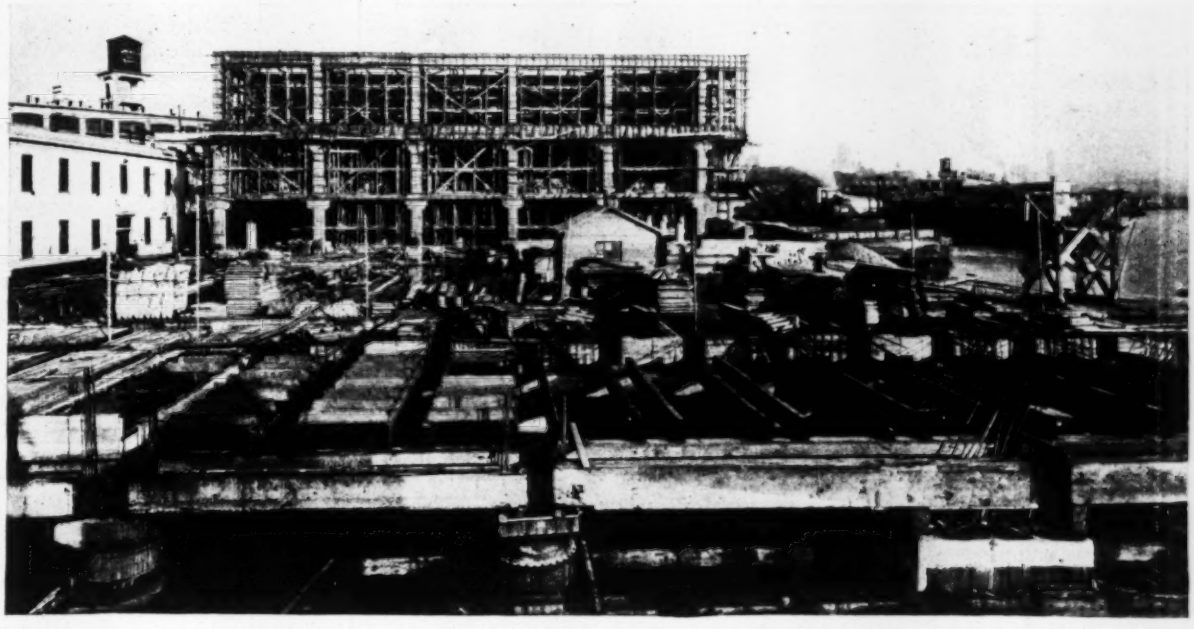


Fig. 3—Deck construction and transit shed follow close behind foundation work

The 4 ft. 6 in. diameter supporting cylinders on 24-ft. centers carry the beam and girder type of deck and the two floors of concrete shed designed for a total live load of 1,800 lb. per square foot.

Strenuous attempts to push the form and precast base back into a vertical position were unsuccessful. The simple solution finally adopted was to unbolt the shaft form from the base after the concrete had been allowed to set, and to insert a circular shim of proper thickness, so that after the rebolting the shaft was plumb.

To provide additional stiffness in the substructure, five diagonal brace cylinders were provided near the outer end of the pier. These diagonals, of the same dimensions as the vertical cylinders, extended from the base of one support to the top of the adjacent one. They were reinforced with twelve 1½-in. round bars and a ½-in. spiral on an 8-in. pitch. The interruption to the routine progress of the job, which had become well established as the work had progressed from the inner pier line, made the introduction of these members an undesired necessity from the construction standpoint, but their introduction was considered justified because of the additional stiffness provided.

To minimize the delay in construction procedure, the design and construction of these braces was worked out to cause as little interference as possible. As illustrated in Fig. 2, the lower end of the brace was attached as a stub to the vertical form. This was done after calculating the respective foundation elevations as closely as possible to provide proper angle for the connection. These particular cylinder forms, assembled as shown, had to be set with special accuracy in regard to orientation, to make sure that the line of the brace fell on the center line of the bent. A timber bulkhead was provided about 4 ft. back from the end of the stub, through which the necessary reinforcing was extended to splice with the main steel in the brace. The cylinder equipped with the stub was mucked and filled in the usual manner, the reinforcing steel for the lower junction being placed before filling commenced. After the vertical form was stripped, the form for the brace was set and bolted on the stub by a diver. This form was then unwatered, reinforcing cages were set and the concrete for the brace was placed in the dry. The procedure necessitated considerable delay in the general rate of construction but proved to be a successful construction operation.

All cylinders were inspected by a diver after the forms had been removed, and it is believed that an excellent job was obtained. The steel shell was allowed to remain in place until the concrete test specimens indicated that the concrete had attained a strength of 3,000 lb. After stripping, a suitable top was cast on the shaft to carry the deck form. The reinforced-concrete deck was of typical beam and girder construction, except that the design was unusually heavy because of the 1,000-lb. live-load requirement. The slab for the typical panels was 6 in. thick, typical beams were 24x36 in., and the girders 30x60 in.

A floating mixing plant was used for all concrete work. The tests on the 1:1¾:2¾ mix showed an average breaking strength of 3,372 lb. for 31 specimens at 7 days, and 4,824 lb. for 41 specimens in 28 days.

The terminal was designed by the American Can Co., of which C. G. Preis is chief engineer. Under supervision of the American Can Co., Henry & McFee, contracting company, Seattle, designed and constructed the pier. W. A. Nopper was resident representative for the American Can Co.; for the contractor M. L. Tibbals was concrete technologist, M. J. Uhrich, superintendent of construction, and the writer was in charge of design and construction. The shed was constructed by the A. W. Quist Co., Seattle.

Land Drainage in Minnesota Faces Financial Failure

Widespread drainage with counties guaranteeing bonds proves unsuccessful—Many counties unable to cover bond issues

UNDERTAKING land drainage for farm development on a large scale, without any topographic mapping or soil studies to determine whether the lands were suitable for agriculture, has proved a costly experiment in Minnesota. A majority of the projects are said to be an economic loss and to have converted into a dry wilderness large areas of swamp and marsh land that should have been maintained as preserves for wild fowl and game. There are about 7,000,000 acres of state-owned swamp and peat lands, mostly in eight northern counties. Drainage of these lands was urged as early as 1891, when farming was prosperous. Legislation was enacted to authorize selling state lands on a 40-year payment plan at 4 per cent interest, and to provide for the organization of drainage districts and the assessment of state lands as well as private lands benefited. Under these laws it was mandatory on counties to pledge their resources for ditch bonds. There are now about 14,500 miles of ditches and 9,000 miles of tile drains.

Since 1905 about $64,000,000 has been invested in drainage projects, of which $32,000,000 is still outstanding in county drainage bonds. In the northern part of the state the drained lands failed to give even a poor living, and the financing of the projects is said to have brought a number of counties near bankruptcy.

A game preserve was created by the state legislature in 1929, in order to return some of the reclaimed land to its natural condition. Of $4,303,000 indebtedness in three counties the state assumed payment of $2,500,000, the counties deeding to it the tax-forfeited land, about 1,700,000 acres. Other counties have sought relief, and in 1931 the legislature provided $1,500,000 for taking over for conservation, reforestation and stream control the forfeited lands in counties that are financially distressed because of drainage bonds. This applies where more than 35 per cent of the taxable property is delinquent and where bonds and interest for drainage purposes exceed 9 per cent of the assessed value of the county. The state is thus acquiring a new public domain.

Rainfall in Minnesota during the past ten years has shown a total shortage of nearly 24 in., or almost a year's normal rainfall. But it has been short also during those periods when precipitation is needed by plant life, while the snow melting in the spring has been carried away from the land by the ditches. One result of these conditions is that drained peat lands have become subject to fire, with large areas burning continually and with destruction of a potential source of fuel. In addition, there have been heavy expenses for maintenance of ditches and drains.

It is not easy to forecast the final outcome of this policy of arbitrary drainage of land and the guaranteeing of drainage bonds. While there have been benefits in southern counties with rolling lands and good soil, the broader results seem to be financial distress in the northern counties and the destruction of valuable peat resources and natural game preserves, together with a financial burden on the state through its endeavor to rectify some of the damage already done.

Composition of Earth Dams

Part IV: Discussion

Stability of the structure during construction needs careful consideration in advance planning—Slides are not unavoidable accidents—Water content of the earth before it is subjected to pressure is more important than size of particles in determining permeability

CONTINUING a discussion of the composition of earth dams, begun in the Dec. 18, 1930, issue of *Engineering News-Record*, two engineers who have been closely associated for several years with semi-hydraulic-fill dam construction here take up the subject of permeability of the outer parts of such dams and the relation of the character and condition of the earth in them to the stability of the structure, especially during construction. Both raise questions as to the soundness of accepted theories and both propose possible improvements in methods of construction, which are worthy of consideration by those interested in earth-dam design. —EDITOR.

Water Content Is a Major Factor in Determining Permeability

By E. McD. MOORE
Saluda, N. C.

TOPOGRAPHICAL FEATURES and the character of the available material determine the type of dam for any given site. Where an earth dam is indicated there is generally no choice of earth for use in its construction. There may be, however, some choice as to method of getting the earth into the dam. If the most economical method is by semi-hydraulic fill, the writer believes that is is possible and practicable, by giving due consideration to the factors involved, to design the dam, regardless of the general characteristics of the available materials, so that it will hold water safely and will be free from the troubles which have been described as the "construction accidents"—namely, slides caused by internal liquid pressure and by sloughing. The writer does not consider that these troubles are accidents, but rather that they are the result of conditions that can be foreseen and prevented by designing the dam to fit the available material.

In any cross-section of any and every semi-hydraulic-fill dam there are five areas composed of three very different grades of material: the core, composed of the fines washed from the two immediately adjoining areas and finer than the average material; the areas on each side of the core, generally considered as all of those areas that have been worked over by the hydraulic giants and from which more or less of the fines have gone into the core, leaving a material coarser than the average; and the two outer areas composed of the material as it comes from the borrowpits, which is the average material.

In discussions of the semi-hydraulic-fill dam much attention has been given to the core and little to the outer areas, except as to their ability to resist the thrust of the core. The fact that the outer areas are made up of two materials having entirely different characteristics has been largely neglected.

The entire areas from the outer edges of the core to the outer limits of the washing have been spoken of as the "washed" areas, and it has been assumed that the fines throughout these areas have been taken into the core. This seems to be in error, as in the finer types of materials very slight, if any, change of gradation of the materials is made until the material reaches the segregation pool.

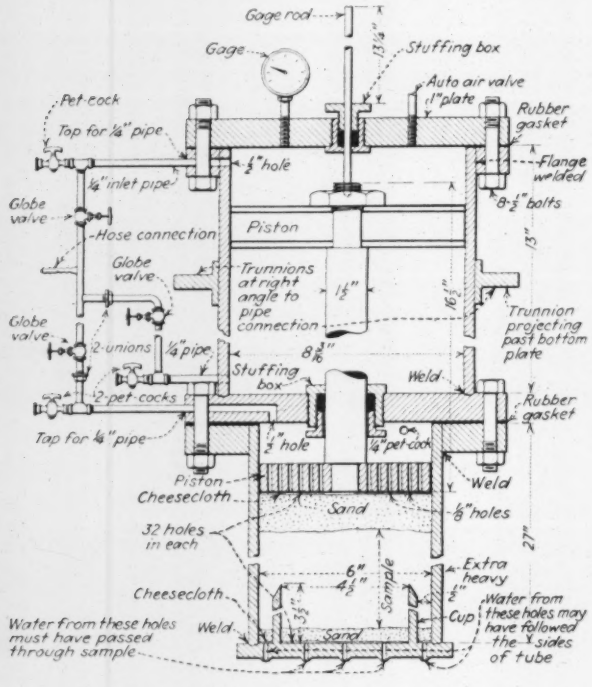
Variations in the borrowpit material as placed in the dam, both longitudinally and vertically, and variations in the washing may, however, result in permeable pockets extending from the highly permeable beach areas out to and probably at times beyond the inner sides of the unwashed borrowpit materials in the outer areas. Throughout the construction period the entire beach area is gorged with water, and as the pool is raised the static pressures throughout the beach areas are continually increased. The smallest trickle of water into one of the permeable pockets eventually carries the static pressure throughout the pocket, and whether the outer area is heavy enough to resist the thrust against it is left entirely to chance. It is the pressures in these areas, the permeable pockets, that are the chief sources of danger, and not the pressure in the core.

It seems to the writer that the troubles described as construction accidents generally have started in these permeable pockets. Therefore, by testing the material that goes into the outer parts (the borrowpit material) under pressure it is possible and practicable to form an idea of its permeability and to determine just how it will behave if subjected to pressure from behind it. If it is highly impermeable, it stands to reason that any permeable area behind it will develop its full static pressure under whatever head it may have, and a slide may result. Also, that, as the borrowpits develop, care must be taken to see that, when variations in the material tend to put more permeable material back of less permeable material, drains are provided to extend through the less permeable into the more permeable material. With such material the washing must be limited to no larger area than is required to produce the amount of fines to make a predetermined core area.

Permeability Tests—Beginning in 1911 the writer first became interested in the movement of water through earth, and at that time made certain tests, which have been described heretofore. However, little progress was made in the studies until about two years ago, when he began to test various earths under pressure in glass tubes. These earths were from highway fills that seemed to be representative of considerable areas of the Piedmont region of the Southeastern states. The glass tubes were not satisfactory.

New tests were then undertaken, using a 4-ft. section of 4-in. pipe, capped and braised at one end, with an air valve and air gage in the cap and a water connection some 5 in. below the top of the cap. A perforated iron plate was bolted to the bottom of the pipe.

With this arrangement an endeavor was made to put the earth under water pressure of 40 lb. per sq.in. and then to lower the pressure to 20 lb. and measure the flow through the earth under that pressure. This was done on the theory that the earth in a dam about 40 ft. below the top exerts a pressure almost twice the pressure



Apparatus used in making soil-permeability tests

of that head of water. This apparatus worked fairly well, but it was uncertain.

In talking to N. D. Urquhart, construction engineer for W. S. Barstow & Company, about the two pressures needed to make a real test, he suggested that a perforated piston in a smaller testing cylinder could be actuated by a larger piston in a superimposed larger cylinder, the areas being proportioned to the specific gravity of the two materials. The apparatus as developed is shown in the accompanying drawing. It consists of two cylinders so proportioned that the water pressure of a given head acting on the piston in the upper cylinder places and maintains on the sample in the lower cylinder the pressure that an earth head equivalent in height would put on the sample. Valves and petcocks are so arranged that any pressures from zero up to maximum water pressure and from zero up to maximum earth pressure, or any combination of the two pressures, can be used on the sample. So far the maximum water pressure used has been 69 lb. per sq.in. The desired condition is not obtained exactly, as the pressure on the sample is of earth at 110 lb. per cu.ft., nor is any allowance made for the added pressure caused by the freeboard of the dam.

Because of the probability of having the results upset by water flowing along the sides of the pipe, a cup has been welded to the inside of the bottom plate. Thus with the sample extending below the top of the cup, both inside and outside, and the outer ring vented, the water following the sides of the pipe cannot spoil the results. Provision is made for a small amount of wedging of the part of the sample going into the outer ring, in the hope that it would tend to choke off the water following the sides. Actual results show that after a few days the leakage from the outer ring area generally is less per square inch than from inside the cup.

A number of tests have been run on materials that were obtained from the bottom of pools and were very fine. These were considered as representative of core materials, and as a test of the reliability of the apparatus, three tests were run from one particular sample, which analyzed:

Per cent passing screen 8	99
Per cent passing screen 35	94
Per cent passing screen 65	88
Per cent passing screen 100	81
Per cent passing screen 200	73
Per cent silt	34
Per cent clay	39

The sample was obtained from under water and was kept in water until tested, so in all cases it was gorged with water. In one test the pressure was started and maintained at 30 lb. At the end of three days the sample had ceased settling, as shown on the gage rod through the top of the top cylinder, and the flow was constant at just under 30,000 gal. per acre-day. In a second test another part of the same sample was put in the tube and the pressure held at 69 lb. In the last 38 hours the total settlement was $\frac{1}{16}$ in. and the flow was 10,150 gal. per acre-day. On the third test the sample was held at 10-lb. pressure until settlement had ceased, then the pressure was raised to 30 lb., then, when settlement ceased, to 50 lb., then again to 69 lb., the full available water pressure. Measurements were taken on the gage rod throughout the test, and at the conclusion the material at the bottom of the upper third of the sample and other material from just inside the cup at the bottom was tested for water content. Using these data and Allen Hazen's table on "Saturated Clay, Specific Gravity of Solid Particles, 2.65," (*Transactions*, Am. Soc. C.E., 1920, p. 1,724) the accompanying table has been prepared.

TABLE I—WATER CONTENT UNDER VARYING PRESSURES

Pressure in Lb. per Sq.In.	Depth of Sample When Setting Stopped, Inches	Per Cent of Volume of 10 Lb. Pressure Volume	Per Cent Voids	Per Cent Water by Weight	Discharge in Gal. per Acre-day	Theoretical Voids Under Complete Consolidation	Theoretical Water Content Under Complete Consolidation
10	17-15/16	100	60.7	36.9	31,700	56.8	33.1
30	16- 9/16	92.3	57.5	33.8	28,100	52.9	29.7
50	15- 5/16	85	54	30.6	21,200	48.5	26.2
69	14- 6/16	80	51	28.2	10,580	44.8	23.4

The per cent of water in the above table was taken in the upper part of the middle third of the sample. At the same time the water content of the bottom of the sample, in the cup, was taken and was found to be 23.4 per cent. Working back from this 23.4 per cent and assuming that the settlement from complete consolidation at 50-lb. pressure to complete consolidation at 69-lb. pressure would be the same that it was from part consolidation at 50-lb. pressure to the same degree of part consolidation at 69-lb. pressure, the last two columns in the table were calculated.

For any material, in tube conditions, there is a limit to its consolidation, and it cannot pass this limit until the pressure is increased. That is, in a dam, if evaporation and capillarity are taken as neutralizing each

other, the degree of consolidation depends entirely upon the pressure.

In tests of whole materials two different earths were used: the red clay earth of the Piedmont areas of the Southeast, and a reddish sandy clay earth taken from the section where the Piedmont formation was merging with the coastal plain formation. In all of these tests another factor enters, which has considerable effect upon the results of the tests of the samples and which the writer believes has an important effect upon the permeability of the outer parts of the dam.

In tests of red clay soils, when the sample was gorged with water before the test, the flow was about twice as much as the flow through the mud samples already shown—that is, these earths ran from 45,000 gal. to 90,000 gal. per acre-day under 30-lb. pressure. But if the sample was only slightly damp when taken from the earth, or if it was allowed to dry out to some extent before it was tested and the pressure was applied to it from the upper cylinder before it was flooded with water, the rate of flow through it might be from one-half to one-tenth the rate of flow through another part of the same sample on which water was turned first. The lowest flow that was obtained through a whole earth to be put under pressure before water was turned on it was 8,000 gal. per acre-day under 30-lb. pressure, or one-fourth the flow through the fines of the same general material. Therefore, in making tests of a borrowpit material for permeability, the water content of the samples tested must be held at the point at which it will probably go into the dam, otherwise the tests do not mean anything.

Segregation in the Core—In the washing process, when the washing is being done on one dike, there is a stratum of material deposited across the bottom of the pool. This material shades from coarse at the washing side to very fine at the far side. The degree of segregation depends upon the pressure and the size of the stream from the hydraulic giant. Small streams under low velocity, not unlike ground sluicing, would seem in dams from this general type of material to give better segregation than larger streams under high velocity. Under any circumstances, when washing takes place on the opposite dike, the fines from the second washing will overlie the coarse from the first washing and the coarse from the second washing will overlie the fines from the first washing. The core will be much zigzagged across its section and highly laminated. Such being the case, is it not probable that a more uniform and a more definitely defined and located core would be produced if all the washing took place from one side, throwing the core to the other side?

The rate of washing determines the segregation in the core. A giant playing downward into the pool will cause more separation than when playing horizontally into the slopes so as to carry everything with it.

Pumping requirements to maintain the pool may be taken as an indication of the conditions in the outer part of the dam. If constant pumping is not required to maintain the working elevation of the pool, it is positive proof that the outer parts of the dam are not draining properly. On the other hand, even though pumping is constantly required, it does not prove that all the outer parts are in safe condition.

Core Limitation—The narrower the core the better, so long as it is wide enough to reduce the flow through it to a reasonable quantity and to hold together under irregular bulging, squeezing and settlement. Further, it must be a construction possibility. A width of 20 ft. at the top and then $\frac{1}{4}$ to 1 slopes would seem to answer all requirements for the core material analyzed here.

The core's width determines the pool's width. In one type of material four parts of borrowpit material must be handled to get one part fines of the same character as can be obtained from one and one-half parts of another borrowpit material. If the material is of the Piedmont type, very little, if any, change is made in the percentages until the material is within the edges of the pool. The washing that is done before the edge of the pool is reached is actually detrimental in that when it does wash out fines it leaves a permeable pocket to be gorged with water as the pool elevation rises above it.

Drainage of the Intermediate Areas—Classifying all of those areas from which the fines have been taken to form the core and any permeable areas that may be caused by variations in the borrowpit materials as intermediate areas, the writer believes that drainage of such areas can be taken care of satisfactorily by incorporating lines of French drains in the dam. At the very start of construction work such longitudinal drains should be laid inside the outer edges of the predetermined beaches, with cross-drains from them laid at intervals to the outer rock toes of the dam. Probably in very fine-grained materials some coarse material should be dumped at occasional places in the beaches and carried up with the dam, so that at all time the drainage can be positive. The bottom drains should be of considerable depth, extending from below the level of the original ground to several feet above it.

The Outer Areas—The chief function of the outer section of semi-hydraulic-fill dams is to hold the inner sections in place. During the construction period the hydraulic process, by its removal of fines and its excess of water, leaves areas that are highly permeable and are gorged with water under increasing static pressure as the pool rises. If permeable pockets extend from these areas out into the outer areas, the pressure that may be built up in them is limited only by the head and the superficial area of the pocket. The net amount of core material secured by washing in the finer types of material is small and spotted, so that on this account the washing should be confined to a smaller section; probably it should be confined to breaking down the material after it has rolled into the segregation pool. Again, if a drier material taking pressure is more impermeable than a wetter material, no washing should be allowed at all on the inner slopes of the fills. At the same time the surface elevation of the pool should be kept at the lowest possible workable levels so that the fills can get the most set possible before exposure to saturation.

As the fills move in toward the pool and approach the section at which dumping will move to a higher level, their inner slopes should be well blanketed with the most impermeable material available from the borrowpits, permeable materials being dumped at other points into the pool for segregation.

The location of the trestles toward the outer slopes of the dam and the drop of the material in the early part of any one lift causes a very considerable compacting at the two sides of the trestles. Just whether the trestles should be located along the outside or should be brought in as far as possible to remain on whole material would seem to be a question that should be considered in every specific case.

Modified Hydraulic Fill—On account of the high im-

permeability of some of the whole earths that the writer has tested, he believes that a somewhat different type of dam should be considered where such earths are to be used. The outer fills in such a dam would be made as in the semi-hydraulic type, but no washing would be done. The pool would be reduced to a trench, about 15 ft. wide, with shallow water maintained in it at all times for its entire length, and the whole material would be dumped to it from the shoulders of the adjoining fills. Building the core in this way will result in the laying down in the bottom of the trench a saturated mass that will give up its surplus water to the dry-placed whole material forming the sides of the trench as the weight of the material dumped upon it increases. The addition of a limited amount of water to the side material and the increasing pressure upon it will force it to assume a condition of maximum density, at which point it becomes impervious.

After arriving at this conclusion the writer re-read (after twenty years) Schuyler's description of the Druid Lake dam, Baltimore, Md. (second edition of "Reservoirs for Irrigation and Domestic Water Supply," p. 444), which runs as follows:

> Druid Lake dam, one of the highest earth dams in America, was built from 1864 to 1870, with a maximum height of 119 ft., a crest of 60 ft. at an elevation of 5 ft. above the flow line, and with inner slope of 4 on 1 and outer slope of 2 on 1. The dam has a puddle-clay corewall in the center, which has a base width of 36 ft. and a crown width of 17 ft., a little above the water line. In the construction of the dam, narrow embankments were first built up on each side of the corewall to a height of 25 ft., the material being placed in layers well rolled. Then embankments of dumped material were built to the same height at the slopes, leaving basins between them and the center. These basins being filled with water, the earth to fill the basins was dumped from the fill banks over the edges into the water until the two basins were filled to the uniform height of the banks either side. Then the process was repeated by building up the corewall with supporting banks of rolled material, followed by dump fills and the formation of pools of water or basins on either side into which the earth was subsequently dumped to fill them. This was a crude form of hydraulic fill, but it was an early recognition of the principle that earth settled under water is more cheaply compacted than would be possible of attainment by other means, while the proven stability of the dam after 37 years' service attests the efficiency of the process.

Earth settled under water does not take its maximum density; dry earth under pressure will absorb a smaller quantity of water than the same earth, gorged with water and then put under pressure, will retain. There may be some critical pressure below which this condition may not hold, but generally it does hold. Earth under pressure has a maximum density when it has no more water in it than it will absorb at that pressure. When the material is at its maximum density it is also at its maximum degree of impermeability for whatever pressure it may have. The Druid Lake dam was not built with this idea in mind, but it is not improbable that the water from the basins percolated out into the fills and that at some point in the fills the material secured no more than its needs to give it its maximum density. The modified type of dam is suggested as one method of securing maximum density and maximum impermeability of fine whole materials, without having the material unable to reach its maximum density on account of its inability to squeeze out its surplus water, which in 15 in. of material under 69-lb. pressure amounted to nearly 5 per cent, the difference between column 5 and column 8 of Table I, in the total weight of the material, or 20 per cent more water than the material's water requirement for maximum density under that pressure.

Stability During Construction Must Be Considered

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NO DISCUSSION of the composition of earth dams of the semi-hydraulic-fill type is complete without considering stability during construction. Special conditions set up by the core pool, by the unconsolidated parts of the core, by saturation of the upstream and downstream fills, by abnormal drawdown of the impounded water and by the relation of the planes of saturation to the downstream slope, all are potential sources of slides or part failure before the dam is completed. They must, therefore, not be overlooked in design studies and in laying out the construction program.

As the basis of stability during construction is freedom from a movement of the dam as a whole or a movement of parts of the dam, commonly referred to as slides, it is necessary to consider these two points in detail.

Movement of the dam as a whole would result from a horizontal force of impounded water or an inclined weight vector being equal to or greater than the friction vector between planes of the earthfill. This condition is very rare. At the Blue Ridge dam a horizontal stratum of a 3-ft. layer of "pipe clay" was encountered in the valley bottom. It was taken out, as it would either have been squeezed out by the superimposed earth or would have caused an ideal condition for lateral movement, since a very low friction coefficient would exist between the clay and the earth. In general, however, the slopes of earth dams, in order to meet the second point—that is, freedom from slides—are flat enough to create a large factor of safety against the movement of the dam as a whole. This point will, therefore, not be discussed.

The movement of parts of the dam or slides during construction have been common in the past. Such movements have occurred on Saluda, Calaveras, Alexander, Bridgewater and other dams. The author believes such movements can be avoided by an understanding of the different types of earth movements or slides, their causes and the ways in which they can be prevented.

Types of Slides—There are four types of slides possible in semi-hydraulic-fill dams. None of them can be given a rigid mathematical treatment. They have in common the fact that their occurrence is usually by a combination of vertical and horizontal movement; also the presence of water in some form is necessary to all. Otherwise they differ. The four types are as follows: (1) slide due to excess of core pressure over weight-friction vector in upstream or downstream fill; (2) slide due to static head of water being built up in the voids of material in excess of the shear resistance; (3) slide due to static head of water being built up in vertical cracks in the fill material in excess of the weight-friction vestor; (4) slide due to static head of water being built up in washed portions of the dry fill between the core and the dry-dumped fill in excess of the weight-friction vector of the dry fill or the core.

The first type of slide has occurred, but it is not common. It usually occurs toward the top of the dam shortly before the segregation pool is removed, as the up- and down-stream fills are then narrow and their weights cor-

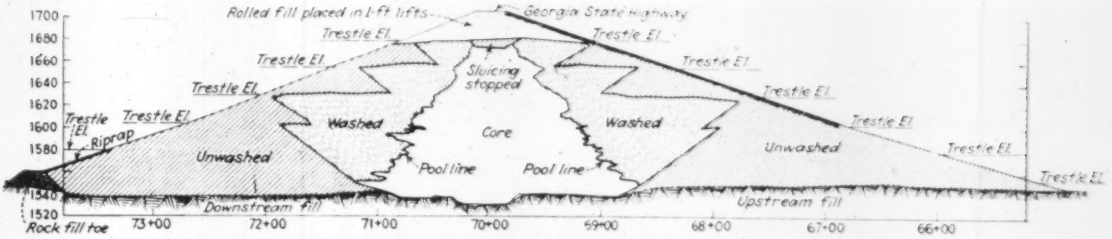


Fig. 1—Maximum section of Blue Ridge dam in Georgia, showing relation of the washed and unwashed fill to the core

respondingly small. This will be obvious from an examination of Fig. 1, a typical section of the Blue Ridge dam. The static head of the core per foot of height at the higher elevation is relatively large, since the core with a small volume has built up fast with little time for consolidation. In general, it may be said that most slides due to core pressure occur only near the top of the dam and then only in the construction stages. Experience has shown that if a core is maintained the width of which is only enough to give impermeability, the conventional 3 to 1 slope will give a section of sufficient weight to retain the core at all elevations except near the top of the dam. At that point extreme caution should be used; and in the event that the available material is extremely fine, the author believes that sluicing operations should be discontinued approximately 25 ft. from the top of the dam and the dam completed by rolled-fill methods, as has been done in the Blue Ridge dam.

Another factor affecting the conditions for the type of slide No. 1 is the width of the core. While it is true that the width of the core has no relation to the pressure it exerts, yet it is apparent that with a given upstream and downstream slope of dam, the wider the core is the less will be the amount of dry fill that retains the core. And the smaller this amount of dry fill the better the conditions will be for a pushing out of the dry fill by the core. There is, therefore, a distinct advantage in having the core only wide enough for impermeability. The width of a core necessary to give impermeability is determined by the fineness of the material and the shape of the particles. The limiting line, as regards fineness of a material for a satisfactory core, was suggested by E. W. Lane in Fig. 2 of his discussion of the composition of earth dams (*ENR*, Nov. 18, 1930, p. 963). Regarding the shape of the particles as they affect the impermeability of the core, but few studies have been made. The author believes that all shapes will be found satisfactory except the very flat particles that are found in soils high in mica. In general for impermeability, the finer the material the narrower the core can be; and the coarser the material the wider the core must be. Fig. 2 illustrates the effect of these requirements upon the core of two dams.

The slide of type No. 1 is also affected by the rate of consolidation of a core. Slow consolidation means greater core pressures. In general, the finer the material of the core the slower the consolidation. Therefore, a core formed from a very fine material must have plenty of dry fill to retain it, or else have a construction schedule that allows ample time for consolidation. Therefore, the greater the fineness of the material, not only the narrower the core can be for impermeability, but the narrower it must be to give the necessary amount of dry fill to retain it. Conversely, the less fine the material, not only the wider the core must be for impermeability, but the wider it can be and still have sufficient dry fill to retain it because of faster consolidation. Fig. 2 illustrates

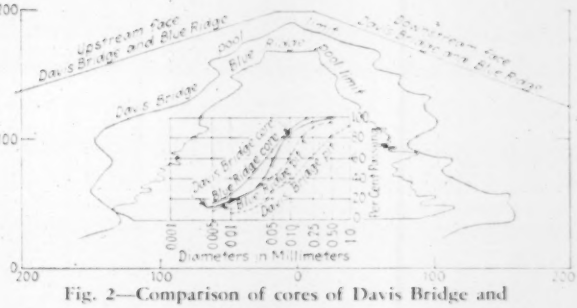

Upstream face Davis Bridge and Blue Ridge dams
Downstream face Davis Bridge and Blue Ridge dams
Pool line
Davis Bridge
Blue Ridge
Diameters in Millimeters

Fig. 2—Comparison of cores of Davis Bridge and Blue Ridge dams

the above points as applied to the relation of dry fill and core of two dams.

Slides of type No. 2 are due to excess of static head of water being built up in the voids of the material over shear resistance. They are the most common type of all slides and the least understood. On the one hand, the forces due to the static head of water in the voids are trying to change the slope on which the material lies; on the other hand, the forces of internal friction are trying to retain the slope. The greater the amount of voids the more water per given volume of material there can be, and, therefore, the greater the forces of change; likewise the more voids per given volume the less the resistance to shear and the less the stability under pressure will be and so the less the forces acting to retain the fill. Thus the entire question is one of voids. In the Blue Ridge dam a given clay with 60 per cent of voids on a 3 to 1 slope was found unstable, whereas the same material with 30 per cent of voids proved stable.

Improper methods of construction are more commonly the cause of this type of slide than is the use of improper material. The conventional method of constructing the fills is by dumping from a trestle until the earth level reaches the top of the trestle, then to throw the track and widen the bank until the washing line is reached. The sluicing operation is then begun. Dumping the earth from the trestles is by no means ideal. It leaves the earth with a high per cent of voids and so in a condition to encourage slides due to a head of water being built up in the voids. A better way to build such fills would be to place the material much after the manner used in building rolled fills or to consolidate it by some other means as it is placed. Of course costs may make such refinements impossible.

Slides of type No. 2 often occur during the drawdown of water on the upstream face of the dam, both during and after construction. This happens because the conventional dragline method of sloping, employed in bringing the face to grade, leaves the material with a high per cent of voids. In this operation the prism of earth *CDE* (Fig. 3) is moved into a prism *EFG*, leaving the material

a loose mass with a high per cent of voids. On small jobs it is preferable to do this work with teams and scrapers, the teams consolidating the earth by tramping. On large jobs where this is not practicable some secondary means of consolidation is advisable.

Slides that occur when the water is drawn down develop because the material, having filled up its high per cent of voids with water, tends to change the slope on which it lies. As described above, the prevention lies in proper consolidation. If this has not been done, the only remedy is to keep water from getting into the voids. This is seldom practicable. Occasionally, before a flood during construction stages, the upstream face can be rolled,

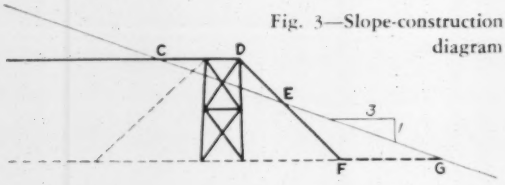


Fig. 3—Slope-construction diagram

thus forming an impermeable face into which the water will not penetrate during the short period of exposure. When the floodwater recedes it will merely run off the face. However, this crust, after serving its purpose, should be broken in places in order to allow drainage from within.

Because no earth material can be placed with zero per cent of voids, a rate of drawdown of the impounded water must be determined. This rate will depend on the amount of voids in the material forming the upstream face and the rate at which these voids can drain. Curves for permissible drawdown rates of the Blue Ridge reservoir are given in Fig. 4. Too fast a drawdown rate will cause a slide of type No. 2.

The third type of slide is due to excess of static head of water being built up in vertical cracks over weight-friction vector. The slide occurs by a triangle of earth being pushed outward by the force due to the static head of water in the crack. Prevention is possible either by eliminating the cracks, by draining them or by keeping water from getting into them. As most of such cracks are due to settlement, proper consolidation of the material will do much to eliminate their formation.

Frequently these vertical cracks form along the plane of the trestles. Heavy rains may fill them, causing this type of slide. As soon as possible after a fill has been made, the slopes should be brought to grade as a means of eliminating these vertical cracks.

Slides that occur in the downstream fill, when the line of saturation intersects the downstream slope, are usually of the third type, though they may also be of type No. 2 or a combination of both. The writer's experience has shown that as long as the saturation line is from 25 to 30 ft. vertically below the surface, there will be no slides. Only in a coarse and free-draining material should the saturation line be permitted to rise to a point nearer the surface. If the core has been properly constructed, then what small movement of water there is through it will readily drain out of the coarse downstream fill. If, however, the movement of water through the core and that coming through the adjoining hills is sufficient to bring the saturation line in the downstream fill too close to the slope or to the point of intersection the downstream surface, the saturation line must be lowered to prevent the type of slide No. 3 or No. 2 or a combination of both. Artificial means of lowering the saturation line, such as well points, drainage tunnels, drainage pits, a blanket of rock, or drains along the intersection of the dam and the adjoining hills, will have to be resorted to.

Dumping earth for the first lift of the fills directly in the riverbed, as is sometimes done, or dumping from the sides parallel to the riverbed and perpendicular to the center line of the dam are both bad practices. Such methods are conducive to subsequent settlement of the fill and thus to the development of slides due to water pressure building up in the cracks. Further, dumping parallel to the river channel facilitates the development of settlement cracks, which will form a direct passage of water into the dam.

The fourth type of slide, due to the building up of static head of water in washed portion of the dry fill between the core and the dumped fill in excess of the weight-friction vector of the dry fill or of the core, is in the author's opinion not as common as many people believe it to be. In this his views go contrary to those expressed by others in previous discussion of this subject. Many slides attributed to this cause are in reality of types 2 and 3, the necessary water sometimes being supplied from the washed portion. Where a fine material is used in the construction of a dam, slides of type No. 4 may be prevented by reducing the amount of washed fill, thus leaving a considerable amount of unwashed fill to

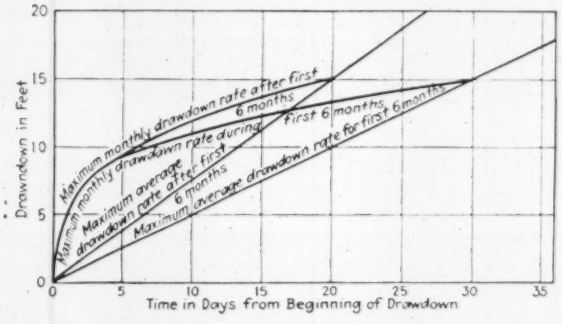


Fig. 4—Drawdown curves for the Blue Ridge reservoir

offset the static head built up in the washed section. Where a coarse material is used and it becomes necessary to wash most of the dump material to obtain enough fines for the core, such slides can be prevented by providing drainage through the dry fill to relieve the static head of water in the washed portion.

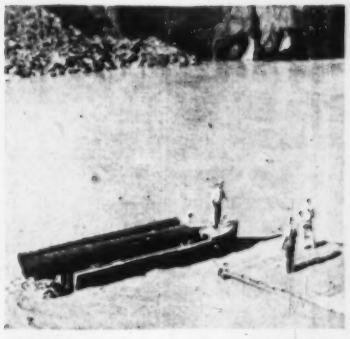
This type of slide can also cause the core to move vertically upward. By bringing the washed bank too close to the pool and by not keeping a wide beach the static head of water in the washed portion can cause a movement that results in a vertical movement of the core. The cure is to remove some of the weight of the dry fill, as had to be done in the Blue Ridge dam.

Future Studies—The ideal earth dam would be one whose upstream face was impervious and whose materials were graded from imperviousness at the upstream face to a high state of perviousness at the downstream face. Such a dam would have watertightness, no uplift and perfect drainage.

The use of soda-ash treatment of soils to form this impervious upstream face merits study. In addition, the use of clay grouting in sand foundations instead of a pile cutoff, the movement of water through cores, the phenomena of core pressures, more economic methods of consolidating earthfills and the relation of the position of the saturation line within the downstream fill to the impounded water level are but a few of the many problems requiring further study.

First Six Months' Progress at Hoover Dam

Remarkable accomplishments during summer of record heat—Boulder City housing and feeding facilities completed—Highways and railroad built to bottom of gorge—14,000 ft. of pioneer headings driven for diversion tunnels



Much equipment was handled by boats to get job started

IN SLIGHTLY LESS than six months from the signing of the Hoover Dam contract the following has been accomplished by the contractor; completion of the main camp and establishment at Boulder City along with an auxiliary camp at the river; railroad construction pushed into the heart of the canyon gorge and toward the Arizona gravel pits 8 miles upstream from the site of the dam; highways built down the steep canyon wall to the lower portals of the Nevada diversion tunnels; more than 14,000 ft. of pioneer tunnel top headings driven for the four 50-ft. diversion tunnels and considerable progress made on the enlarging of three of these tunnels from the outlet portals. In addition, innumerable minor features of construction work in connection with the project have been carried on. All this was accomplished during a summer when the temperatures at the dam site reached a maximum of 128 deg. and for 90 consecutive days registered an average daily maximum of 110 deg. and an average 24-hour temperature of 97 deg. Added to this terrific heat was the acceptance of a national responsibility to put hundreds of men at work as quickly as possible, even before adequate housing facilities could be prepared and when Boulder City was only a stretch of desert. In the face of all this the contractor, Six Companies, Inc., has accomplished a smooth and rapid beginning of an outstanding construction project.

Half a year ago the contractor was concentrating on getting up temporary buildings on the site of Boulder City and had only survey parties at the scene of actual construction. Today, the program of permanent buildings at the town has been practically completed and the center of activity has swung to the dam site proper. Nearly 3,000 men are at work, provided with the most complete housing and feeding facilities ever furnished for a construction force. The accomplishments of the first six months on this project and some of the construction program outlined for the future are described briefly in the following.

Boulder City—Required by contract to house 80 per cent of its working organization in Boulder City, the

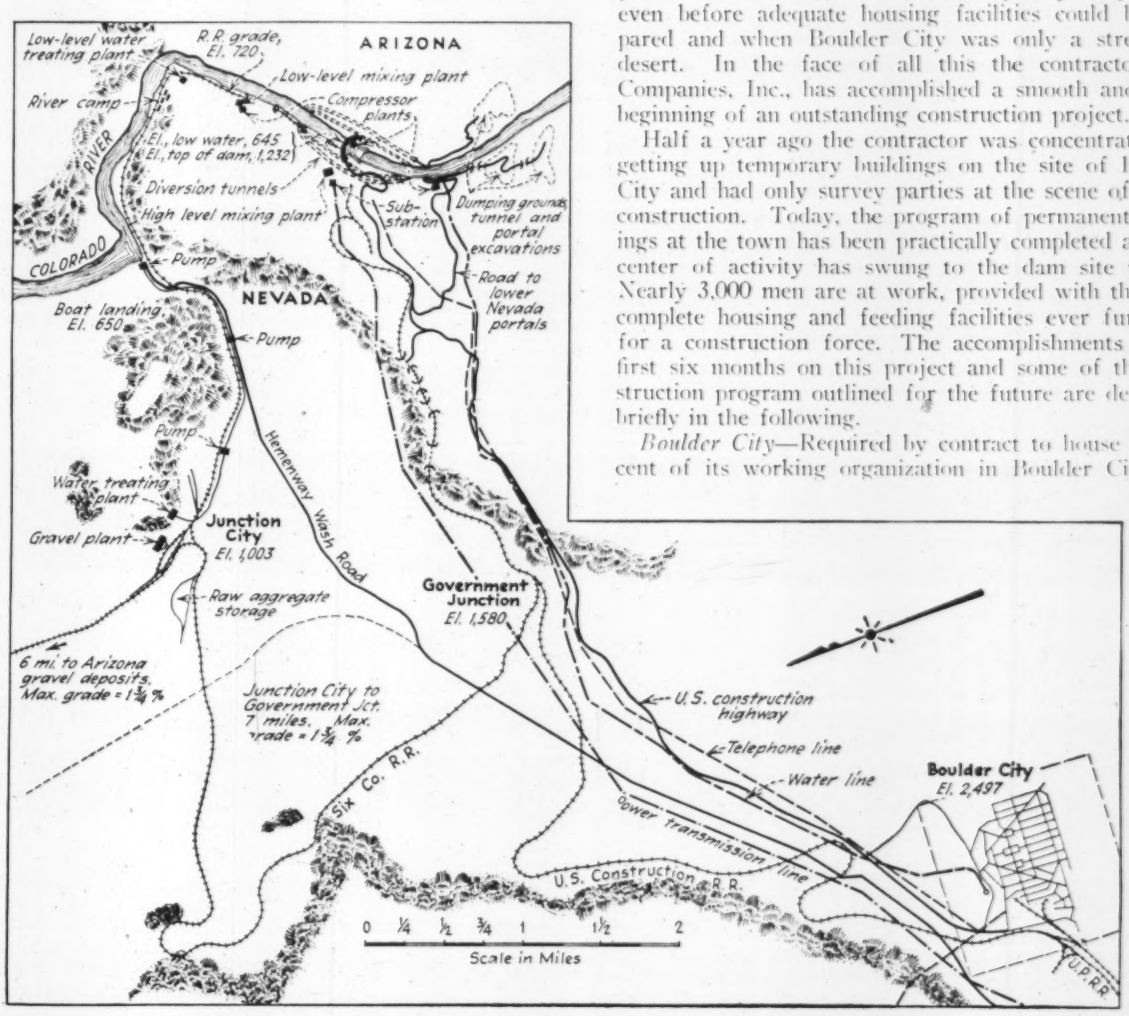


Fig. 1—Map showing location of various construction operations at Hoover Dam

contractor has rushed the erection of seven 172-man dormitories, 136 three-room houses and about 175 two-room cottages, in addition to several administration buildings and shops. The type of construction used in these buildings, their location in the town, and the municipal facilities provided for this population, were described in *Engineering News-Record*, Nov. 26, 1931, p. 846.

The living quarters in dormitories, together with bedding, including sheets and pillow cases, are provided at a charge of 10c. per day. The family houses will be available for those desiring to rent them at a charge estimated to amortize the cost of construction during the period of the job.

The mess hall, which seats 1,100 men at a time, has food-handling and kitchen equipment considered to be the most complete and best ever provided for a construction job. Refrigeration equipment is ample for storing perishable goods and dairy products in carload lots. Cooking equipment can be operated by oil, electricity or steam. Twelve meals a day are served at tables provided with individual chairs, by waiters in white uniforms. An unusual feature of the feeding arrangements is the provision by which food for the men's lunches is made available for individual selection, so that each man can choose exactly the kind and amount desired. The charge for board is $1.50 per day. The providing of housing and feeding facilities has cost the Six Companies about $140 per man.

Supplementing this Boulder City housing program a 500-man camp has been established at the river about 1 mile upstream from the dam site. This camp was important in taking care of the crews before Boulder City buildings were ready and will now be used as an equalizer in maintaining that part of the force needed closer to the main operations.

Railroad Construction—Taking off from the government's construction railroad, which runs from Boulder City to the top of the canyon near the dam site, the contractor is building a railroad line down Hemenway Wash a distance of 7 miles on a 1.75 per cent grade, to a junction point (see map) where a 500-ton-per-hour gravel-washing plant and the aggregate storage will be located. From this junction one branch of the railroad runs north a distance of 7 miles on a falling $1\frac{3}{4}$ per cent grade to a point on the river across from the Arizona gravel deposits. It was originally planned to bring the gravel across the river by belt conveyors on a suspension bridge to a loading hopper at the railroad terminal. However, further study indicated the desirability of constructing a railroad trestle across the river, which will permit loading the gravel directly from the pits into railroad cars. This was considered to be more economical, even though the trestle may be washed out two or three times. The untreated aggregate material will be delivered by train to the washing and screening plant at the junction.

The other branch of the railroad from the junction runs to the river at the upper end of Black Canyon and continues down into the canyon in solid rock cut or tunnel on a level grade approximately 75 ft. above river level. This branch will be extended to the dam site and possibly to the lower portals of the diversion tunnels and will be the principal means of access to upstream parts of the work. Its primary uses will be: (1) to remove tunnel muck from the up-stream end

Fig. 2—Work goes on night and day at the bottom of Black Canyon

Two views taken from same point looking down-stream from high on Nevada rim. Highways in distant center of lower view lead to outlet portals of Nevada diversion tunnels. Suspension footwalk across river can be seen in both views.

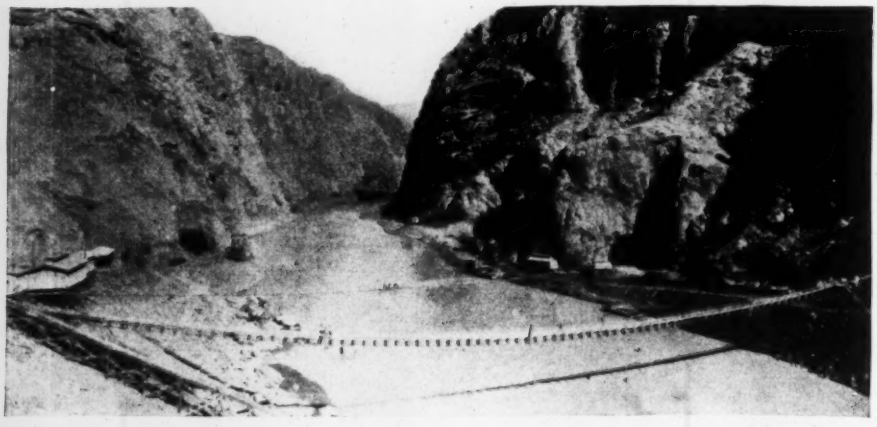


Fig. 3—Up-stream view from bottom of canyon showing lower portals of three of enlarged headings of diversion tunnels. Site of dam is just beyond rocky point jutting into river from Arizona (right) side.

of the diversion tunnels; (2) to build the upstream cofferdam; and (3) to bring concrete materials to the site. These concrete materials will be delivered dry to a mixing plant at railroad level 4,000 ft. upstream from the dam; this (low-level) plant will be used only for the tunnel lining and the lower part of the dam. After water storage is started, during the last years of construction, the railroad in the canyon will have to be abandoned, and concrete aggregate will have to be transported from the junction back up the government line to a high-level mixing plant located somewhere on the Nevada canyon rim above the dam. Plans for these operations have been worked out only in a tentative way at the present time.

Grading for this 26 miles of railway, which was not particularly heavy except in the canyon section, is now completed except in the gorge. Rail laying (90-lb. steel) has been completed on all the graded section. In the canyon extremely heavy rock excavation was required, including the driving of two tunnels near the dam site. One tunnel, 1,000 ft. long, has been finished; the second tunnel, 1,100 ft., will be holed through soon. Completion of this railroad work will make the actual dam site accessible to standard-gage railway equipment, whereas up to this time only barge transportation has been available.

It is estimated that the cost of this railroad construction work will be approximately $1,000,000. Plans have been made to electrify about 12 miles of the line. Thirty-five million tons of material will be handled by it during the construction period, involving 398,604,000 ton-miles of hauling. According to the terms of the contract, the operation and maintenance of the government railroad line from Boulder City to the dam also is part of the Six Companies' operations.

Highway—Except for barge transportation on the river, access to a point of attack in the gorge was obtained first by a construction road leading from the government highway down a rocky draw on a 10 per cent grade to the downstream portals of the Nevada diversion tunnels (Fig. 2). Building this road involved about 70,000 cu.yd. of rock excavation. It is being used at the present time to transport men and equipment from Boulder City to the site. Near its lower end many branches have been run out into side canyons for the disposing of tunnel waste. As the contract does not permit dumping into the river, 6,000,000 cu.yd. of rock must be hauled out. Material now being removed from the lower end of the diversion tunnels, therefore, is being trucked up steep construction roads on both sides of the river into side canyons for disposal. The trucking road on the Nevada side is being extended through a 500-ft. tunnel to give access to dump room in a large side canyon.

In addition to this highway work done for construction purposes, the contract included the building of 4,000 ft. of standard highway that will extend the existing government highway from its present terminal on the canyon rim down to the top of the dam on the Nevada side. The grading (heavy rock excavation) is about half done, and work is under way on the masonry retaining walls and parapets.

At present the only access to the Arizona side of the river is by four suspension foot-bridges or by boat. All heavy equipment and supplies now in use on the far side have been taken across by barges. The crews living at the river camp are also taken to and from work by boat through the canyon. Present plans call for the immediate construction of heavy suspension bridges at the upstream and downstream portals, designed for trucking loads. This will facilitate the handling of supplies and equipment and permit the removal of tunnel waste more efficiently. Work is also being started on anchorages in the canyon walls for the several cableways that will span the gorge for handling excavated material and concrete.

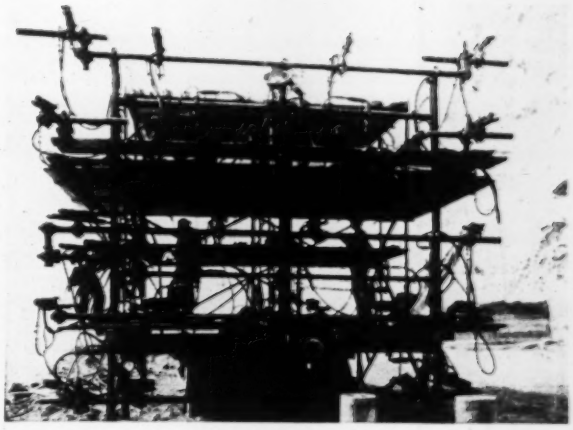


Fig. 4—Enlarged tunnel headings are drilled from truck carriage handling 25 drifters mounted on five horizontal bars

First of these carriages was built of timber, but latest model, shown here, is built of structural steel with welded connections.

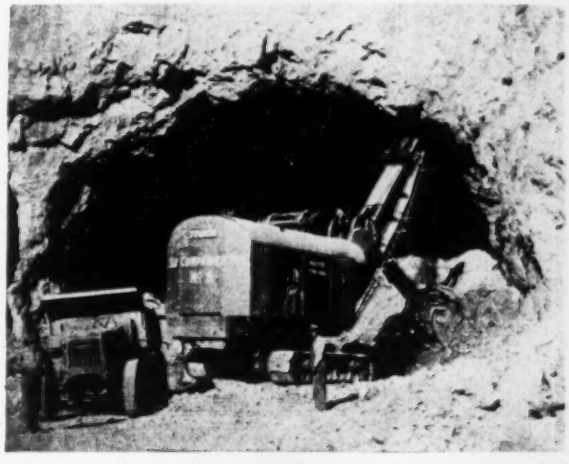
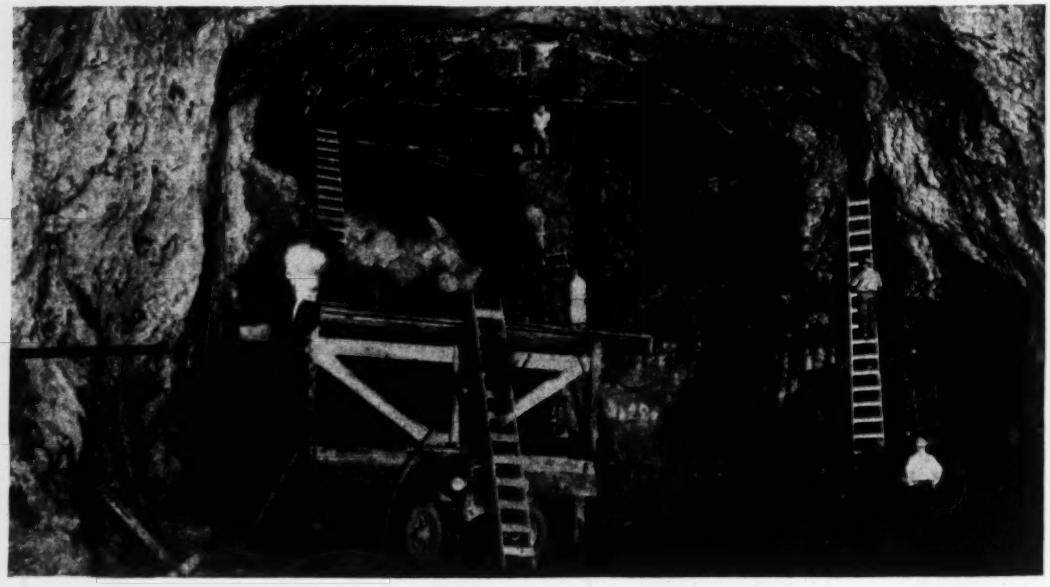


Fig. 5—Electric 2½-yd. shovels load muck in enlarged headings directly into trucks. Note steel hood over truck driver's seat for protection against falling rocks.

Tunnel Operations—Progress on the project as a whole is dependent upon the completion of the four 50-ft.-diameter diversion tunnels (56 ft. inside of rock, 3 ft. concrete lining), two on each side of the river, required to divert the stream before work can be started on foundation excavation. It was important to get this work under way immediately and to carry it forward while the other preliminaries, such as camp and railroad construction, were under way. The attack on the 4,000-ft. tunnels is from both up- and down-stream portals and from two additional faces in each, opened up by adits driven in from the canyon wall at about midpoint.

Using boat transportation even before the construction road to the downstream portals was available, the



Union Pacific Railroad Photo

Fig. 6—Truck drill carriage at face of enlarged heading, lower end of outer Arizona diversion tunnel. Pioneer tunnel top heading was not driven in this particular section. Instead a 12-ft. top heading is carried ahead of main face

contractor brought in equipment and established a foothold at the adit locations on the sheer canyon walls. Driving two adits on each bank, he reached the first tunnel line 350 ft. in and the second 650 ft. in. The eight faces thus opened were started at once, driving 12x12-ft. top-center headings. Work was concentrated on the two tunnels nearest the river, and headings were opened up from the downstream portals. The downstream halves of these two pioneer tunnels were holed through in September, and enlargement to 41x56 ft. is now under way, leaving a bottom bench. Various systems of drilling are being tried to determine the most practicable means of enlarging to the full 56-ft. diameter.

One of the important purposes of these headings was to determine the character of the rock to be encountered. The results have proved most satisfactory, the rock working and handling exceptionally well.

More than 14,000 ft. of top heading has been completed, the two inner tunnels being holed through from portal to portal. Active work as the upstream portals has been awaiting completion of the railroad that will be used to transport the tunnel waste out through the upper canyon. However, the upstream portals have been opened up ready for driving.

The downstream portal of the outer Arizona tunnel is being opened up to a 41x56-ft. section without a pioneer heading. A top bench about 12 ft. high on center line is carried forward ahead of the main section. Behind this the full-width face to a depth of about 4 ft. is carried forward, using drills mounted on a carriage built on a motor-truck frame. This type of mounting (Figs. 4 and 6) is another experiment at the present time. Muck in this heading is removed by a 2¼-yd. electric shovel loading directly into trucks (Fig. 5).

Cofferdams will be required at all portals when driving has been started to full cross-section, because the elevation of the tunnel invert is about 10 ft. below normal river stage. It is planned to erect small concrete arch dams for this purpose, which will be removed upon completion of the tunnel work.

Three main compressor plants have been established at the up- and down-stream portals on the Nevada side and the adit on the Arizona side. Air is piped across the river on separate suspension spans from each plant. These plants are all electrically operated and will be standardized on a 6,000-cu.ft. capacity, with two 1,000- and two 2,000-ft. machines in each plant.

Miscellaneous Features—There are 35 trucks now in operation on the job. Tunneling operations at the present time are utilizing three 2¼-cu.yd. electric shovels. More than 20 miles of 2,300-volt transmission line has been built and 50 miles of telephone line. Scaling of the canyon walls is under way around both upstream and downstream portals.

A water-softening and purification plant, with a capacity of 400,000 gal. in 16 hours, is under construction 200 ft. above railroad grade level at the upstream end of the canyon. This plant will provide water for concrete mixing, railroad use and river camp supply.

Organization—All work of the Six Companies, Inc., is under the direction of Frank T. Crowe, general superintendent, reporting through a construction committee to the board of directors of the organization. Charles A. Shea, director of Six Companies in charge of construction, spends most of his time on the job. A. H. Ayers is chief engineer, and Bernard Williams is construction assistant in charge of work in the canyon. J. P. Yates is office engineer, with a staff of ten; and B. W. Goodenough is in charge of the field engineering parties, totaling 25 men. Floyd Huntington is tunnel superintendent.

Contract for the board of all employees has been let to the Anderson Bros. Supply Co., Los Angeles; Harold S. Anderson is in personal charge of these operations. John Phillips Co., Los Angeles, had the contract for the railroad grading, and Shannahan Bros., Los Angeles, laid the track. Supervision of the project by the Bureau of Reclamation is in direct charge of Walker R. Young, construction engineer, reporting to R. F. Walter, chief engineer, Denver office.

Ohio Rushes Bridge Building to Relieve Unemployment

Three hundred bridges costing 3½ millions contracted for winter construction with local labor except for supervision of construction

By J. H. BURKEY
Chief Engineer of Bridges, Ohio Department of Public Works, Columbus, Ohio

AN APPROPRIATION of $3,500,000 is being expended on small road bridges in Ohio this winter to provide work for unemployed men. Of this sum $3,000,000 is state and federal road money advanced from the 1932 allotment, and $500,000 is a county cooperation fund. Bridge work was selected as being the most adaptable of all roadbuilding operations for prosecution in cold weather. Also it could be scattered to give opportunity for employment in all parts of the state. A survey of all road bridges in the state, which was completed this summer, had shown that about one-third were either too light or too narrow to serve the present traffic.

General Planning Procedure

The decision to carry on this bridge work was made during the last week of August. Immediate instructions were issued to the division engineers to prepare and submit to the central office of the department of highways, not later than Sept. 1, a list of bridges in their respective districts, the construction of which they felt would help most to relieve unemployment and at the same time best serve the needs of traffic. This list was to include at least one and one-half times the number of structures that could be built with the available funds.

These lists as submitted were carefully studied by members of the highway department with reference to the geographical location of the proposed structures, as well as to the condition of the structures to be replaced and the traffic on the highway where the structure is located. The planning engineer, chief engineer of bridges and other representatives of the bridge bureau and the respective division engineers then decided the projects that in their opinion should be included in the program. At this conference it was determined generally whether the structures to be built at the various locations should be of steel and concrete or creosoted timber, and a rough estimate was made of their probable cost. As soon as the program for all divisions had been prepared, the entire program was summarized and submitted to the director of highways for his approval.

The governor in the meantime had organized the state relief committee, composed of members of his cabinet and the state commander of the American Legion. This committee organized with Adjutant General Henderson as chairman and collected data as to unemployment throughout the state.

The original list as made up contained 380 structures, which was more than could be built with the available funds. In conference with the state relief committee, the relative merits of the various projects were considered, and the number of structures was reduced to 292, of which 88 are to be of timber construction and the rest of steel and concrete types. The accompanying map shows the location and type of the structures that are finally included in the program.

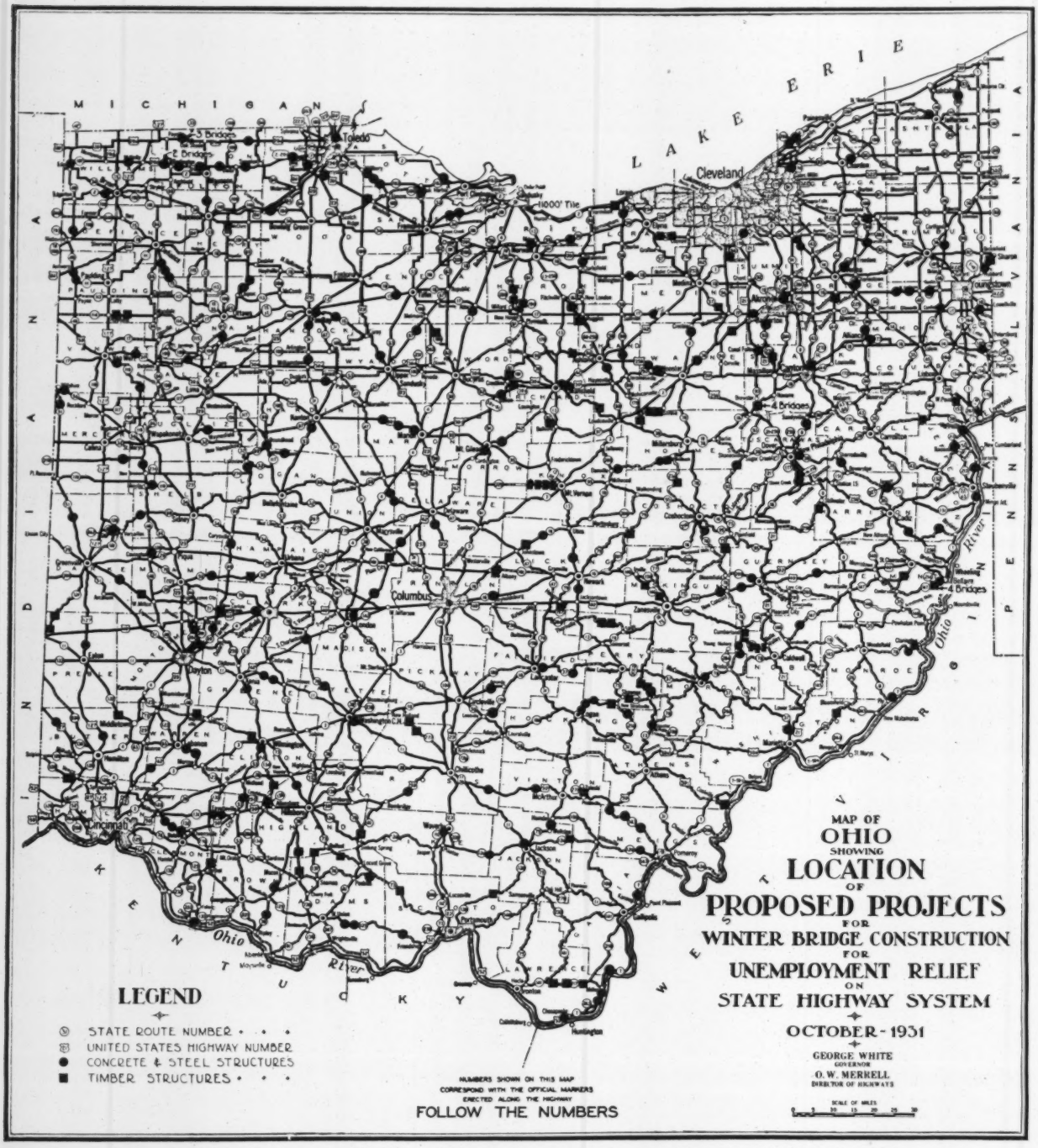
A working schedule was set up calling for lettings to start early in November and to continue at approximately ten-day intervals until the entire program should be under contract by the end of December. This required unusual speed in making surveys and preparing plans and estimates. While much of the drafting had to be done in the various local highway engineers' offices, it was necessary to establish a close central control to avoid the many errors that creep into emergency work so widely scattered.

A site plan for each structure was prepared on tracing cloth by the resident engineer and forwarded to the bureau of bridges. This plan set forth the existing conditions and was accompanied by a letter containing recommendations and comments. The plan was studied by one of a large group of trained bridge designers, who sketched on this sheet the type, size and location of the proposed structure, together with detailed instructions to be observed in the preparation of the detailed design. If the contemplated design was quite complicated, it was assigned for completion in the central office of the bureau. If the design was to be typical, it was assigned to the local engineer, who was furnished standard plans or completed designs of a similar type as a guide for details. In all cases prints of the designated type, size and location of structure were submitted back to the division and resident engineer for criticism before the inking of detailed plans began. Extensive use was made of the telephone and telegraph in transmitting helpful suggestions.

Terms of Contracts

In order to afford the anticipated relief it was necessary not only that contracts be awarded as soon as possible but that the contractor be required to carry on his work continuously from the time of the award of the contract until the completion of the project; also that the contractor be required to pay a fair wage and as far as practicable employ local labor. To accomplish these results the following provisions are included in and made a part of the proposal or bidding form:

> As part of this bid and proposal, the undersigned bidder hereby agrees that he will pay not less than the established minimum wage (35c. per hour in the rural counties, and varying to 50c. in Cuyahoga County, where Cleveland is located) for any class of labor necessary to complete the work, without charge or deduction for transportation, rental of tools or any other items, and that these provisions shall be a part of any subcontract entered into in connection with the project. Payroll records



Location of winter road bridge construction operations for unemployment relief in Ohio

shall be open to the inspection of the state's representative at all times.

The undersigned bidder further agrees that in the carrying on of winter bridge construction for emergency relief the contractor shall, in so far as practicable, employ labor from lists furnished to him by the country relief committee, provided that such lists contain the names of three times as many men as he desires to employ. The contractor shall request such lists from the committee, setting forth the number of men to be employed; and should the committee fail to supply such lists within 24 hours of the receipt of such request, the contractor shall be free to employ any available labor. The contractor shall select from such lists at least 85 per cent of the labor required on the project at any time, except that he may without regard to these requirements employ such men as are necessary for supervision of construction and for the operation of power equipment requiring skilled operators. Any laborer found to be incompetent may be discharged and replaced in accordance herewith.

The committee referred to above is a local relief committee set up in each county along the lines established by the state relief committee. The department of highways has no part in the selection of laborers to be employed by the contractor. Without raising the question

of its legality, this was deemed the only practicable manner of providing employment for those most needing it, availing ourselves at the same time of the advantages of the contract system of doing public work. The proposal also contains the following provisions:

> The undersigned bidder also further agrees that the prices quoted in this proposal contemplate winter operations and the completion of the project on or before the date specified. Pay items designated by item numbers given in the general specifications shall be governed by the provisions of the general specifications and of the supplemental specifications for winter bridge construction for emergency relief. In all cases of conflict the supplemental specifications shall prevail. Any portion of the work not completed by the date set for completion shall be paid for when accepted, at a unit price 15 per cent below the respective unit price bid, subject, however, to the provisions for adjustment of contract time for completion under Sec. 8 of the supplemental specifications for winter bridge construction for emergency relief. The usual charges for engineering, inspection and maintaining detours, as provided in the general specifications, shall not be affected by the above provisions.

The supplemental specifications referred to are special specifications making it mandatory for the contractor to work continuously through the winter, and at the same time safeguarding the work.

The dates set for completion of the projects are such that the work must be continuous from the time of awarding the contract. If the completion date is May 1 or later, the project must be all completed by that time. If the date for completion is prior to May 1, a later completion date will generally be given for the completion of approach slabs, wearing surface, approach pavement and field painting of structural steel. The reason for making these exceptions is that the difficulty and cost of properly constructing and protecting these items during the winter months is out of all proportion to the advantages of having them constructed at that time.

So as to prevent work from being stopped by ordinary high water, as is usual during the winter, it is provided that the minimum height of cofferdams shall be midway between low and high water, as shown on the plans. By the terms of the specifications the contractor is entitled to an extension of time for authorized extra work, or for the duration of flood beyond height of cofferdams, or for suspension of work for just cause by the director.

Immediately upon the awarding of the contract the contractor must arrange for the shipping and storage of aggregates sufficient to complete the project. This is necessary, due to the difficulty of securing shipments during winter months, as most of the quarries and sand and gravel plants are not operating then.

For all concrete placed before April 1 and for that placed after April 1, when air temperature is 50 deg. F. or below, the water and aggregates must be heated so that the concrete when placed in the forms shall have a temperature of at least 70 deg. F. Suitable inclosures and heating devices shall be provided, and the air temperature surrounding the forms and newly deposited concrete shall be kept to a temperature of at least 50 deg. F. for a period of at least 120 hours when standard portland cement is used, and 72 hours when high-early-strength cement is used. Salt or chemical admixtures shall not be used.

The deduction of 15 per cent for any work uncompleted at the specified date is not set up as a penalty, but rather as the withdrawal of a special premium, which is figured in the cost of doing work during the winter season, and upon which basis bids were received and contracts were awarded.

The specifications for timber bridges, which are described as bridges whose superstructures are essentially timber (although it may involve the use of steel stringers), and whose substructure may or may not be of timber construction, were so written that the state is to furnish all creosoted lumber or timber and piling, delivered either at the bridge site or at the nearest railroad siding. All of the lumber and timber is to be oak, except piling, which may be chestnut or oak.

The company furnishing this creosoted timber bids to furnish all of the timber in any division delivered to any point in that division at the same unit price, stating in its bid whether delivery is to be at the bridge site or at the railroad siding nearest the bridge location.

Special Plans for Timber Bridges

As plans for a given structure are completed, a copy is sent to the creosoting company or the company furnishing creosoted lumber, and it shall immediately fabricate and creosote the lumber and piling required for this structure and ship it when ordered to do so by the department.

The state will have engineers or inspectors at the creosoting plants to inspect the lumber before and after creosoting to see that it is of proper quality and grade and that the specified retention of creosote oil is obtained. They will also inspect and check the fabrication of all parts and see that the shipment made for each structure is complete. To insure against shortage and to prevent delays, additional flooring and backing to the amount of 5 per cent of that shown on the plans and one extra pile for each twenty or fraction thereof shown on the plan shall be included in the shipment. For the treatment of field cuts a specified quantity of creosote oil shall be included with each shipment. To expedite checking and avoid costly omissions, a standard form has been developed for the billing of materials. This must be filled by the creosoting company and approved by the state's representative at the plant before shipment.

In the past, creosoted materials were always furnished by the bridge contractor, but in this emergency work it seemed necessary for the state to furnish it, placing the order at the earliest possible date. Green timber must necessarily be used. Artificial seasoning is to be accomplished by boiling in a vacuum. Bids for the creosoted lumber and piles were received on Oct. 24, and the order for the needs of the entire state was divided between two companies.

The contractor for the erection of the bridge is to unload, haul and erect the structure if the creosoted timber is delivered at the railroad siding, and to erect the structure if it is delivered at the bridge site. He is to furnish all other materials except creosoted lumber and piling required for the completed structure.

In the painting of structural steel it is required that all surfaces that will later be inaccessible shall receive the full three coats (as required for shop and field painting) under shop conditions

All untreated timber in timber bridges requiring painting is given a prime coat under suitable conditions.

When strip floor is used on steel beams the strips are fastened to the upper flange of the beam by suitable anchor plates or cleats spaced 1 ft. centers on opposite sides of the beam.

At the start of this program the department had no standard plans for timber bridges, although a few creosoted timber bridges had been built. A design was developed that is simple and easy to construct. It is designed for H-15 loading and a 24-ft. roadway,

although greater widths are provided in special cases. The beam spacing for all spans is 3 ft. Timber beams are used for the very short spans and steel I-beams for the longer spans. The floor is 6-in. creosoted-oak strip, with a bituminous-mat wearing surface.

The use of the timber structures is confined to secondary roads, or cases where there may be a future change in location. Two-thirds of the structures consist of the usual types of reinforced concrete or steel structures. Considerable use is made of rolled girder beams, especially in structures of three or more spans where continuous beam action is available to reduce moments and deflection. This type of construction, together with concrete deck structures, is given favorable consideration on account of adaptability to future widening.

The first sale was held Nov. 6, at which time bids were received on 38 structures at an estimated cost of $578,863.44. The low bids totaled $414,292.44, a cut of approximately 28.4 per cent. Other sales will be held approximately every ten days until the whole of the program is under contract.

Many contractors were interviewed before starting the estimates for this winter work, since the element of mandatory operations throughout the winter was new to us. Our estimates, the unit prices of which are not made public, were based quite largely upon the composite judgment of these builders. A cut of 28.4 per cent below our estimates may bring grief to the low bidder, but in general the class of successful bidders in the first letting of our winter program ranks just as high as during our normal season. At least Ohio will have made an effort to relieve some of the unemployment during the winter and may learn that construction of this type can be carried on economically for the public and with a stabilizing effect on building.

This work has been developed by the combined efforts of all the engineers in our department, under the immediate supervision of the writer. W. H. Rabe is chief designing engineer of bridges. W. G. Smith, as field bridge engineer, and C. L. Moyer, as planning engineer, had most to do with the selection of projects. H. P. Chapman is chief engineer of the department, and O. W. Merrill is director of highways.

Winter Road Work for Unemployed

SUPPLEMENTING other articles in this issue describing individual state programs for winter unemployment-relief work on highways, personal inquiry in a number of representative roadbuilding states brings out the encouraging indication that highway departments generally are doing what they may to assign routine maintenance for winter prosecution and to award early contracts to encourage the beginning of work this winter.

Connecticut

By C. G. NICHOLS

Executive Deputy Highway Commissioner of Connecticut, Hartford, Conn.

TO ASSIST in providing work for the unemployed, and following the practice of the last two winters, highway commissioner John A. Macdonald has been accelerating the preparation of plans, estimates and other necessary data for the purpose of awarding contracts for road construction during the season, when under normal conditions actual road work would be greatly curtailed. These contracts, of course, will be confined to that class of work that can be done economically during the freezing and thawing periods, characteristic of the climate in Connecticut.

While no accurate or definite estimate can be given at the present time of the amount of money available for such work, the budget plan of the highway department enables the commissioner to have an accurate statement each month of the amount of money available. The department's income is derived exclusively from motor-vehicle fees and fines and gasoline taxes. These are reported to the department the last calendar day of each month, and statements are prepared for the commissioner for his immediate consideration.

At the present time plans are ready for at least one letting during December. The particular character of construction considered involves in some instances relocations on which grading and the removal of rock will be necessary. The plans do not contemplate any work involving the construction of road surfaces.

During the last two winters it has been possible to advance work on many proposed improvements, and much of the work was accomplished during the winter.

Indiana

By C. H. PARRISH

Indiana State Highway Department, Indianapolis, Ind.

THE INDIANA highway commission, co-operating with Governor Harry G. Leslie, in a program of relief through employment, has on its payrolls 1,700 more men than at this time last year, and is spending $125,000 a month solely for work made for unemployment relief. This program will extend well into the winter, and a part of it through the winter.

Building construction includes five new garages at various district maintenance headquarters to cost $8,000 to $12,000 each, three of which are let to contract and two erected with department forces; a new central garage in Indianapolis to cost $120,000; ten storage sheds for machinery and equipment at various locations in the state to cost $1,500 each and one large storage shed in Indianapolis to cost $10,000.

This state has under way about 190 miscellaneous road-improvement projects, such as widening, cutting corners and changing grades, to cost about $1,000,000. This work started some time ago and is about half completed. The remainder will be carried on into the winter so far as it is practicable. Under normal conditions it would not have been undertaken until next spring.

The department is now employing double the number of men employed last season at this time. Most of the work is handled in the maintenance division, and the following gives an idea of increased employees:

	1930	1931
September	2,351	3,654
October	2,152	4,079
November	1,851	4,504

The commission has absorbed 947 miles into the state system in the last few months, 500 miles at the request of Governor Leslie because they lend themselves admirably to extending a better road service in sections heretofore not so well served and are situated in localities where unemployment is most acute. Local labor is used, and the character of the secondary maintenance being given calls chiefly for hand labor. The department's augmented use of gravel and stone in this secondary maintenance on new roads has materially aided employment in related industries such as gravel pits and stone quarries.

Early this fall the commission adopted a schedule of eight hours per day for maintenance workers, when formerly the daily time was nine hours. This procedure permitted taking on 900 more men regularly at the same cost to the state. It is planned to pave at least 500 miles in 1932, and on Nov. 24 contracts were let for 60 miles. The commission asked the contractors to do as much grading as possible when weather permits, and not to exceed a 54-hour per week schedule, in order to spread work among as many unemployed as possible. The department has an extensive bridge program and will start work on many structures during the winter.

Minnesota

By J. T. ELLISON

Chief Engineer, Department of Highways, St. Paul, Minn.

IN SO FAR AS POSSIBLE we are planning on early contracts for the work which we contemplate doing next year, with special attention to those jobs upon which a certain amount of work can be done during the present year. In line with this we have already placed our contract for all of the cement that we propose to use on paving projects during 1932. This will, of course, indirectly give employment to many men during the winter.

We have also a certain amount of clearing and grubbing preliminary to construction on various projects in the northern part of the state. It is intended to clear the right-of-way on these projects during the winter, to work rather short days, and to rotate employment to a certain extent.

Bids are being received and contracts let for a number of projects, many of which can be worked on at least a part of the winter. Contracts have recently been awarded for some heavy grading, involving a considerable amount of rock excavation, upon which work can be conducted through the greater part of the winter.

The routine maintenance work continues with approximately the same payroll during the winter months as during the summer, although a great part of the special work must of necessity be discontinued. On account of the unemployment situation we have recently appropriated $60,000 to the maintenance department, to be used largely as a relief fund, in that no part of this money is to go to men regularly employed by the highway department, but to others throughout the state who are in urgent need of employment. This money is being expended largely for work that would not otherwise have been done but which is desirable; it is being used for cleaning out ditches, clearing right-of-way, cleaning up back slopes and general improvement work.

Other States

Iowa—According to F. R. White, state highway engineer, Iowa plans no more winter work than its normal large-bridge construction because (1) weather conditions are such that winter work cannot be carried on; and (2) because no funds are available for any unusual highway operations due to the heavy construction operations of the past summer. Regarding large-bridge work it is stated:

> For many years we have made a practice of building most of our large bridges during the winter months. This class of work can be handled even though the weather is quite severe. This practice enables bridge contractors to keep a number of their best construction men engaged, and thus have a nucleus of their organizations available when the active construction operations open up in the spring. It also enables the highway commission to keep a number of its best inspectors employed and likewise have them available when larger operations open up in the spring. We will carry on the usual amount of large-bridge construction work this winter.

New Hampshire—It has been found practically impossible to carry on construction work during the winter in New Hampshire, excepting large fills or ledge work, and the state has practically nothing planned this winter except the regular snow-removal program. F. E. Everett, state highway commissioner, states that the department did, however, anticipate the winter's unemployment by allotting an extra $200,000 for intensive necessary maintenance work on both the state-aid and trunk-line systems, and it is being expended in such a way as to insure practically 100 per cent for labor.

The money was allotted to practically all towns in the state and is being used to clean ditches, flatten curves, widen the existing highways, and for some gravel-resurfacing work. By distributing the money in the above fashion more real assistance has been rendered than could have been possible by winter work on a few projects, as in this manner road work has given approximately half a million hours of work to the unemployed.

Massachusetts—According to A. W. Dean, chief engineer, department of public works, Massachusetts will have under contract (including contracts already let) road work to the value of approximately $4,000,000 during the winter months, which work, if the weather is reasonably good, will provide employment for a large number of men. In addition to this contract work, it is proposed to expend about $100,000 on work such as opening up vistas on curves and general tree-trimming, and a considerable sum also in making ledge and earth excavation at curves and intersections where the view is obstructed.

Illinois—A recent statement by Governor Louis L. Emmerson, of Illinois, is as follows:

> During the winter it is planned to let contracts for more than $34,000,000 worth of road work, so that materials may be assembled during cold weather, and road work started as soon as the weather permits in the spring. County highway engineers, co-operating with the state, are also hurrying their plans for state-aid roads and hope to let several million dollars' worth of contracts during the winter. At the lowest estimate, road construction in Illinois during 1932 should total 1,500 miles and give direct employment to at least 24,000 men, and indirect employment to many thousands more.
>
> So that Illinois labor may reap the full benefit of the money to be spent by the state, the highway department will include in all of its contracts, a provision that the contractors shall use Illinois labor residing in the vicinity of the work and that fair rates of wages shall be pad. The only exception regarding the use of local labor will be a few of the contractors' superintendents and skilled men.

New York plans to do no more than is usually done in winter. Pennsylvania has a quite extensive program planned but withholds all details of amounts and kinds of work.

Winter Road Work Prominent in New Jersey Relief Program

Special legislation provides for financing local public-works projects—Highway funds used for maintenance work on state roads

STATE, county and municipal governments in New Jersey are cooperating in the stimulation of immediate public-works construction to provide emergency employment during the winter months. Recognizing the existence of an emergency, Governor Morgan S. Larsen recently called a special session of the legislature, which passed a number of laws creating a state emergency relief administration, facilitating the acceleration of public construction projects and providing for the emergency financing of such work.

Centralized control of the relief work, without undue interference with local initiative, is assured by requiring all local programs to conform to regulations promulgated by the state relief director, whose approval is necessary before a county or municipality is eligible for state financial aid. Thus the planning, selection and supervision of relief projects remain under local control, but the state contributes to the cost and acts as a stabilizing factor in equalizing wage rates, hours of labor and other details. Administration costs are held to a minimum by having the state director and his principal assistants serve without pay, and by using, as far as possible, the services of public officials in the relief organization. Chester I. Barnard, president of the New Jersey Bell Telephone Co., has been appointed state relief director.

A wide variety of projects is embodied in the local construction programs, including city-planning studies, the repair and remodeling of public buildings, sewer and water-main extensions, grade-crossing eliminations and many other types of municipal improvements. Road and street work provide a fertile field for the use of labor, not only in cities and towns but also on county and state highways. Money from gasoline tax receipts has been made available to the counties, on a dollar-for-dollar basis, for wage payments on road work. The state highway department on its own initiative has put into effect a widespread program of winter highway construction and maintenance, expanding a plan inaugurated last year when it gave employment to 2,400 men at a cost of $900,000.

Highway department activities, although not an integral part of the emergency relief program, are now coordinated with the work of the state and local relief committees in that the men are employed upon the recommendation of these bodies. The department has nothing to do with the investigation of applicants and their needs; it simply notifies the relief administration that work can be provided for a certain number of men at a given time and place, and accepts the workers assigned to it. Discharge for disciplinary reasons is within its authority. A wage of 50c. per hour is paid for common labor, the working time being seven hours per day and five days per week. The customary plan is to work all men two weeks at full time (weather permitting) and then to lay the gang off for two weeks to make room for another. Timekeepers are paid $100 per month. Foremen are paid at the scale used in ordinary maintenance operations and are largely recruited from the permanent force of the department. No arrangements are made for food or lodging, as local labor is used. In some cases it has been necessary to provide daily transportation for distances up to 20 miles because most of the projects are in rural territory.

The work being done on the state highway system consists of grading, road widening, top-soiling, fertilizing, seeding, sodding, small drainage construction, painting and, in general, operatons in which hand labor can be used to a large extent. Although practically all of this is necessary work, much of it in normal times would probably have been deferred because of the many demands upon highway funds. By special arangement with the contractors, certain items on a number of existing contracts have been turned back to the department for completion by hand, thus increasing the quantity of work available for relief. In such cases one or more of the contractors' foremen are often taken over.

Possible projects are reported to headquarters by the various division engineers, and selections are made in accordance with the local need for employment. At the present time 2,083 men are at work, a number that will be largely increased in the near future. Much of the labor is inefficient, consisting of men who can only find employment during boom times. Because of the poor

Bills Passed by New Jersey Legislature to Facilitate Work Relief

1. An act creating a temporary state emergency relief administration, in charge of a state director who controls policies, supervises expenditures and appoints county relief organizations; suspending civil service regulations as affecting relief work; and appropriating $8,000,000 to be expended as follows:

$4,041,334 to municipalities, allocated $1 per capita, to cover 50 per cent of actual wages paid for work relief.

$3,232,067 to municipalities, allocated 80c. per capita, to cover 40 per cent of dependency relief programs.

Balance, including unexpended parts of money previously allocated, for administration and additional aid to municipalities as ordered by the state director.

In addition, the act diverts $1,616,033 from gasoline tax revenues, allocated 40c. per capita, to be used in county relief programs, covering 50 per cent of wages paid for work on county and municipal roads. Unused balances revert to a general county fund for additional aid to counties as ordered by the state director.

2. An act making it a misdemeanor to give false information in applying for relief.

3. An act permitting the use of any unexpended balances from previous appropriations for work relief.

4. Several acts authorizing municipalities and counties to issue short-term emergency bonds for financing relief programs approved by the state director, and providing for the exemption of such bonds from debt limitations.

quality of the labor and because machines are used as little as possible, the return to the state is low as compared with contract work. Efficiency varies considerably in different classes of construction; on small drainage and grading operations it approaches 100 per cent, while on larger undertakings it is much less satisfactory.

No special financing has been necessary in carrying out the highway department's employment program, all expenses being met from current revenues. In anticipation of a need similar to that experienced last year, the department planned its 1931 construction program so as to have a surplus at the end of the normal construction season, and it is this money that is being used to provide employment. In accounting, no attempt is being made to segregate the excess cost of unseasonal work performed at low efficiency from the normal cost of the project. Such work as is done on new highways is charged, as usual, to construction; other classes are charged to maintenance. Actual supervision, however, is concentrated in the maintenance division of the department, which is headed by A. W. Muir. Jacob L. Bauer is chief engineer of the state highway department.

Michigan Plans Winter Road Work to Relieve Unemployment

Contracts being let for work costing ten million dollars and giving employment to 30,000 men

By GROVER C. DILLMAN
State Highway Commissioner, Lansing, Mich.

ACTING in line with the unemployment relief plan urged by Governor Wilber M. Brucker and the state unemployment commission, the Michigan state administrative board at its meeting on Oct. 9, 1931, authorized a plan of emergency winter-road construction recommended by state highway commissioner Grover C. Dillman, providing for the immediate placing under contract of projects amounting to $10,000,000, which it is estimated will give employment to approximately 30,000 workers. The work is to be confined largely to grading and drainage structures on road projects, and to bridge and grade-separation construction. This type of work requires a considerable amount of hand labor, which will employ the maximum amount of unskilled labor. To do this, however, there must be eliminated equipment operations that ordinarily would be most desirable.

Projects are to be located as far as possible according to the urgency of the need for unemployment relief. While all sections of the state will be granted a portion of the work in both the upper and lower peninsulas, it is generally conceded that the need for relief is the most acute in the southern part of the lower peninsula, and this need is receiving first consideration.

A large number of betterment projects are also being put on by the department's own maintenance organization or through the various county units handling state trunk-line maintenance work. Under the heading of betterments are included such items as grade widening, lengthening of curves and roadside development.

Special provisions for the employment and use of labor are made a part of the contract requirements. Contractors are required to employ all labor in accordance with the rules and policies of the state unemployment commission. As soon as a contract is awarded, the contractor notifies the commission in Lansing of his needs for labor, and requests a list of men from which he may select his requirements. The list or lists of unemployed are then furnished the contractor through the county unemployment committee or committees designated by the commission. Contractors must employ at least 75 per cent of all labor used on the work from the lists of the unemployed so furnished. However, if the total number of men employed per shift is less than sixteen, including superintendent and foreman, the contractor is allowed to employ regularly four men, including foreman and superintendent from sources other than the lists furnished. Any laborer found to be incompetent is discharged, but it is required that replacements be made from the lists.

It is required that the contractor employ those hired from the local committee lists on the basis of two shifts per week, or on the basis of one week of work and one week of lay-off. The minimum wage for common labor has been fixed at 35c. per hour, and the wage for the skilled labor shall not be less than the prevailing wage for similar kinds of work in the locality. Subletting of any item of work to individual laborers at a piece-work rate that would not permit the laborer to earn the minimum wage is not allowed.

Where camps are operated by the contractor or by persons affiliated with the contractor, a charge of more than $5 per week for board and lodging is considered a violation of the minimum wage specified herein; also the charging of more than the market price for supplies from the company store is prohibited.

Certified copies of all payrolls are required, such payrolls showing the name of the employee, place of legal residence, class of work, rate paid, hours worked and the committee from which the name was obtained, together with a proper receipt signed by the employee for each payroll check.

Requirements for Hand Labor

All excavation and backfilling on bridges and culverts must be done by hand shovels, team scrapers, wheelbarrows and carts. Unless otherwise specified, the excavation is to be removed from the foundations by hand, elevating the material by stages in the cofferdam.

Aggregates are unloaded from freight cars by hand and handled from a stock pile to the mixer by hand shovel, wheelbarrows or carts. Cement and reinforcing steel is unloaded and placed by hand, and in the case of structural steel, all spans up to 60 ft. are placed by hand by the use of falsework where necessary. All carpenter work and finishing of concrete surfaces is being done by hand. Concrete is transported from the mixer to its place by the use of carts or wheelbarrows. Any other work not specifically listed above, on which hand labor could be used, shall be done by hand in so far as is practicable.

The use of power equipment for grading is not permitted, except where covered in the special specifications for the work; and where the use of power equipment is permitted, material is transported by the use of teams or trucks, hauling not more than 2 yd. per trip. Hand labor, wheel scraper or fresno work is required. Ditches

must be trimmed by hand or by the use of board scrapers. All trimming must be carried close to the rough grading operations. The right-of-way clean-up work must also be carried close to the grading operations. All clearing and grubbing shall be done by hand labor, and trenches for tile shall also be dug by hand.

Whenever feasible, team work is required in place of draglines in gravel pits. In general, teams and graders are given preference over tractors and trucks in compacting and floating the gravel surfaces.

Financing and Costs

Unit contract prices under these special provisions are running very low, in fact will not average more than 10 per cent above earlier 1931 contract awards. In view of this fact, we are still getting more for our money than during normal times, and in addition are contributing in considerable measure to the employment of thousands of men who otherwise would be out of work, or at least dependent upon the county, township or city for the necessities of life.

As this winter work will be an obligation against the 1932 state highway funds and as these funds will not be available until after 1932 license plates are sold, arrangements have been made with Michigan banks to provide the necessary financing of construction projects until state funds are available. Contractors are able to obtain financing from banks on the estimates of the project, the loan to become binding upon the state's highway funds and to be retired as rapidly as possible in 1932. The boards of county road commissioners are cooperating with the state highway department in financing to a large extent betterment work on state trunk lines within their respective counties. The counties and some municipalities are furnishing equipment rental-free for use on betterment work.

Tests Reveal Low Infiltration Rate on New Jersey Outfall Sewer

By ELSON T. KILLAM
With Alexander Potter, Consulting Engineer, New York, N. Y.

INFILTRATION TESTS on a reinforced-concrete pipe sewer built in 1929 by the Second River Joint Meeting, of Essex County, N. J., showed an unusually low amount of groundwater leakage. With diameters varying from 24 to 60 in., the total amount of infiltration in a length of 20,530 ft. was found to be 1,610 gal. per mile per day, only 13 per cent of that allowed by the specifications.

The line includes three stream crossings and 4,488 ft. of pressure pipe. It was laid to relieve serious pollution of the Second River caused by the surcharging of an old sewer built in 1893 by the city of Orange. Necessity for additional capacity is borne out by flow measurements taken soon after the new sewer was put in service, which indicated a dry-weather flow of about 16 m.g.d. and stormflows of 22 m.g.d., as against a limiting capacity in the old sewer of 12.8 m.g.d. As constructed, the new line is 20,530 ft. long, with a diameter varying from 24 in. to 60 in. and a weighted average diameter of 46 in. It drains an area embraced within the larger area known as the Passaic Valley System and discharges into the latter system near the junction of the Second River with the Passaic River. The lower section was designed for a capacity of 75.3 m.g.d. when flowing 0.7 full, which capacity, together with that of the old sewer, will meet estimated requirements for 1960.

Construction was begun in November, 1928, and was completed in December, 1929. The cost of construction (exclusive of overhead, rights-of-way and engineering) was $530,000, or $25.80 per foot. Average depth of cut was 12.5 ft., 42 per cent of the total excavation was in rock, and, with the exception of 330 ft. of 48-in. tunnel, the entire line was constructed in open cut.

Construction Details—Part of the sewer, a section 4,488 ft. in length divided between two contracts, was constructed as a pressure line with precast reinforced-concrete pipe. Joints on one contract were made with lead fiber-center gaskets pointed with cement inside and outside, and on the other were tongue-and-groove pressure joints, pointed on the outside with mortar. In an effort to expedite progress during the winter several lengths of pipe were shipped to the job without allowing sufficient time for proper curing. This pipe, placed immediately in a heavy cut, developed slight hair cracks after the backfill was placed. The condition was corrected by bracing the pipe from the inside. Specifications for the pressure pipe required that it be built for a working head of 20 ft. and be subjected to a leakage test under a 35-ft. head, with a limit of leakage of 300 gal. per day per inch-mile.

The rest of the line was of standard precast reinforced-concrete pipe, 24 to 60 in. in diameter and 3 to 6 in. in thickness. Joints were made with cement mortar on the first contract and with a patented joint compound on the other.

Stream Crossings—Three stream crossings were made by means of rectangular flattened sections of reinforced concrete. The invert of these sections was laid to grade, and the width was designed to provide a cross-sectional area equivalent to the area of the line above and below the special section. In all cases it provided for a minimum velocity of 2 ft. per second. Center heights were 1 ft. 10 in., 3 ft. 3 in. and 1 ft. 10 in. for main-line diameters of 42, 60 and 45 in. respectively.

No maintenance has been required to keep the flattened

LEAKAGE TESTS OF SUPPLEMENTARY UNION OUTLET SEWER, 1929

	Size, In.	Length Ft.	Length Miles	Leakage Gal. Per Day	Leakage Gal. Per Mile Per Day	Per Cent of Specified Maximum	Remarks
Contract A	51	2,644.8	0.500	1,000	2,000	16.7	Water table at center of pipe (note *a*)
	60	2,881.8	0.546	1,500	2,740	22.8	Water table 7 ft. above invert
	54	609.9	0.115	200	1,740	14.5	Water table above top of pipe (note *b*)
	42	3,293.3	0.623	1,000	1,600	13.3	Six pumps required during construction (note *c*)
	33	1,327.0	0.250	100	400	3.3	Pumped 1 m.g.d. during construction
	24	1,843.2	0.350	600	1,710	14.3	(Note *d*)
	Total	12,600	2.384	4,400	1,840	15.3	.....
Contract B	45	2,128.9	0.402	0	0	0	Water table varied in elevation to 4 ft. above invert
	54 51 48	4,185.7	0.792	0	0	0	Dry ground (note *e*)
	30	1,430.6	0.270	3,100	11,500	96.8	*Before calking.* Water table at crown
	30	1,430.6	0.270	1,800	6,660	55.5	*After calking.* Water table at crown
	Total	7,745.2	1.464	1,800	6,600	10.3	.....

(*a*) No appreciable increase of leakage during storms when river was higher than pipe.
(*b*) Included monolithic river crossing; leakage estimated as to small to measure.
(*c*) Includes 900-ft. standard precast pipe 2067.3 ft. pressure pipe and 276 ft. monolithic river crossing.
(*d*) Estimated, as house connections were made during construction.
(*e*) Includes 969.5 ft. 54-in., 567.4 ft. 51-in., and 2648.8 ft. 48-in. pipe.

sections free from obstruction. At a fourth crossing, however, an inverted siphon formed by two parallel lines of cast-iron pipe, it is necessary to remove weekly a considerable quantity of rags and débris.

Infiltration—The specified allowable rate of infiltration in the gravity sewer was 12,000 gal. per mile per day, with a supplementary provision allowing twice this rate for sections less than 500 ft. long, provided the total rate for the contract did not exceed the rate first stated. Although the greater part of the work was constructed under troublesome groundwater conditions, infiltration was found to be usually low, averaging 1,610 gal. per mile per day for the entire job, equivalent to about 13 per cent of the rate allowed under the specifications.

Variations in rates of infiltration under various groundwater conditions are shown in the accompanying table. Leakage was measured in most cases by the use of a 90-deg. V-notch knife-edge weir. On certain sections the amount of leakage was so small that it was impossible to measure it by this method. Tests were made subsequent to the completion of a substantial section of sewer and after the groundwater had risen to its normal level. With very few exceptions the low rates of leakage mentioned were obtained without calking.

The new sewer was constructed by the Second River Joint Meeting, a body representing the municipalities of Belleville, Bloomfield, East Orange, Glen Ridge, Montclair, Newark and Orange, all in Essex County, N. J.

Tests on Large Concrete Pipe Sewer Show Kutter's *n* to Be 0.014

Flow at one-third depth in 60-in. conduit—Velocities measured directly by floats and dye

By ELSON T. KILLAM
With Alexander Potter, Consulting Engineer, New York City

FLOW TESTS on a 60-in. reinforced-concrete sewer constructed in 1929 by the Second River Joint Meeting in Essex County, N. J., showed an average value of the coefficient of roughness, *n* in Kutter's formula, of 0.014 when the depth of flow was about one-third the diameter. Velocities in the test length of 2,209 ft. were measured directly by partly submerged surface floats and by the use of eosine dye, and were in the vecinity of 4 ft. per second. Surface slopes had an average value of 0.00172, slightly less than the slope of the invert. A description of the sewer is given in the preceding article.

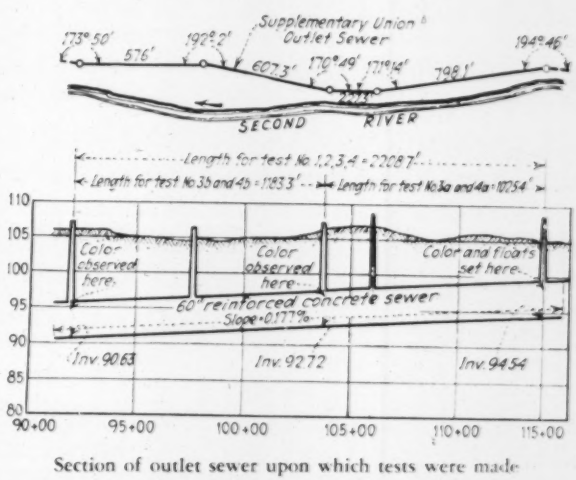
The section chosen was particularly favorable for such a test as there were no increments of flow and only three deflection angles, of about 10 deg. each, in the lenth of 2,209 ft. The sewer is of 60-in. precast reinforced-concrete pipe in 4-ft. lengths with cement mortar joints. The three manholes are so constructed as to cause no disturbance to flow.

Test Methods—Elevations were taken on manhole rims and inverts subsequent to construction, and levels between manholes were checked against a line of benches run for construction purposes. Distances to the water surface were measured by lowering a swinging weight attached to a steel tape until the square end cut the water surface. The depth was then read at the top of the tape, which was held against a wire stretched taut across the manhole top.

Velocities were measured both by the color method and by surface floats. The floats consisted of partly filled pint bottles submerged about 6 in. For the color tests both eosine and potassium permanganate were used with good results. Eosine is a phenol dye of coal-tar derivation that produces a bright, reddish color intermingled with flashes of green. Potassium permanganate produces a dark purple color that fades to a brownish tint after oxidation. Eosine, which gave more satisfactory results, is more expensive, costing $3.20 per pound, as compared with 40c. per pound for the potassium permanganate. The cost of coloring material is so small in proportion to the total cost of conducting such tests, however, that there is no advantage in using any but the most satisfactory material. Both floats and dye were set simultaneously from near water level and were not dropped from the top of the manhole.

For the first test ½ gal. of eosine solution, with a concentration of 1 oz. to 3 qts. of water, was used, but the amount was insufficient and no color could be observed at the downstream station. For tests 2 and 3, 1 gal. of eosine solution with the same concentration was used, and it was easily discernable at the downstream manhole. For tests 4 and 5, 1 gal. of potassium permanganate solution with a concentration of 2 oz. per gallon was used; and although the various stages of color could be observed, it was found to be less distinct than the eosine, probably because of the change in color to dark brown and coincident oxidation. It was observed that the color appears first in the center of the section, reaches its maximum intensity at about the mean time of appearance and disappears from the center of the stream while still perceptible in the area of low velocity along the sides.

One stopwatch was used for time measurements. The observer started the watch when the color was applied in the upstream manhole, then ran dowstream and took the time of arrival of floats and color. With stations 2,200 ft. apart and 4-ft. velocities, this method was not particularly convenient, but it was carried out in order to eliminate any error that might result from observations made by two individuals using different timepieces.



Section of outlet sewer upon which tests were made

Slopes and Depths—The slope of the invert was 0.00177, whereas the observed slope of the water surface, used for computing values of n, varied from 0.00162 to 0.00183, with an average for all tests of 0.00172. The flatter slopes were due to a slight backflooding effect at a restricted section below the downstream manhole. The difference in depth of flow in the reach under test was found to be negligible, varying from 0.03 to 0.16 ft., with an average of 0.10 ft.; the depth in every case but one was greater at the downstream manhole. In the computations the average of the depths at the upstream and downstream manholes for each test was used.

RESULTS OF TESTS TO DETERMINE VALUE OF KUTTER'S n

Test Number	Velocity, Ft. per Sec. Based on: Surface Float	First Appearance of Color	Last Appearance of Color	Mean Time of Color Appearance	Distance of Color Travel	Depth of Flow: Difference in Depth at Upstream and Downstream Manhole	Mean at Upstream and Downstream Manhole	Slope of Water Surface, Per Cent	Proportional Depth	Hydraulic Radius	Values of Kutter's n With Velocity as Indicated by: Surface Float	Time of First Appearance of Color	Time of Last Appearance of Color	Mean Time of Color Appearance
1	4.64	4.20	3.74	3.96	2,209	0.08	1.490	0.1734	0.298	0.850	0.0123	0.0133	0.0150	0.0141
2	....	4.13	3.78	3.94	2,209	0.08	1.420	0.1734	0.284	0.818	.....	0.0133	0.0147	0.0139
3	4.28	3.99	3.84	3.92	2,209	0.13	1.395	0.1711	0.279	0.805	0.0126	0.0135	0.0141	0.0137
3a	4.58	4.12	.....	.....	1,025	0.16	1.410	0.1620	0.282	0.813	0.0118	0.0128	.....	.....
3b	4.05	4.24	.....	.....	1,183	0.03	1.475	0.1792	0.295	0.843	0.0138	0.0134	.....	.....
4	4.25	4.04	3.71	3.87	2,209	0.11	1.385	0.1720	0.277	0.800	0.0127	0.0134	0.0147	0.0138
4a	4.46	4.17	.....	.....	1,025	0.16	1.410	0.1620	0.282	0.813	0.0120	0.0126	.....	.....
4b	4.08	3.93	.....	.....	1,183	0.07	1.455	0.1830	0.291	0.834	0.0138	0.0147	.....	.....

Computed Results—Values of n computed from the various observations ranged from a minimum of 0.0118 to a maximum of 0.0150. These extremes are not comparable, however, as the former is based on surface velocity as measured by floats, and the latter upon the time of disappearance of color. Results of all tests are shown in the accompanying table. The average value of n derived from all observations was 0.0135, substantially the same value as that obtained by averaging values based on the mean time of color appearance, 0.0139.

Basis of Velocity Measurement	Values of n: Minimum	Average	Maximum
(1) Surface floats	0.0118	0.0127	0.0138
(2) Time of first appearance of color	0.0126	0.0134	0.0147
(3) Time of disappearance of color	0.0141	0.0146	0.0150
(4) Mean time of color appearance. (Average time obtained by (2) and (3))	0.0137	0.0139	0.0141

Probable Range of Error—Using test No. 1 as a basis, if the actual time were 3 sec. greater than the recorded time, the value of n would be 0.014217 instead of 0.014156, indicating that a very substantial error in time measurement would be necessary to change the value of n from 0.014 to 0.013. If the actual depth at the downstream manhole were 0.1 ft. less than that recorded, the value of n would change from 0.014156 to 0.014038. The change is very small because of the fact that with less depth at the dowstream manhole the value of r is smaller and the value of s greater, and these two offset each other.

Variations in Velocity—The ratio of mean color velocity to surface velocity varied from 85.4 to 91.6 per cent, with an average of 89.7 per cent. A pencil accidentally dropped into the sewer during test No. 4 showed a center surface velocity of 4.75 ft. per second, compared with 4.25 ft. per second for the bottle floating 6 in. submerged, and 3.87 ft. per second for the velocity by the color method.

Conclusions—Summarizing results, the tests herein described indicate:

1. That even with good quality concrete pipe, accurately laid with smooth joints and no interference to flow, the value of n for sewers flowing one-third full should not be assumed to be lower than 0.014.

2. That reasonably consistent results can be obtained by the color-velocity method even with fairly large volumes of sewage.

3. That the period during which the color is visible at the downstream station is approximately 10 per cent of the total elapsed time of color travel in the sewer.

4. That the ratio between mean color and surface velocities, with fairly high rates of flow (3 to 5 ft. per second) and with the pipes flowing one-third full, is 89.2 per cent, a fact to be considered when observations are made only by surface floats.

Upon casual examination the values of n indicated by these tests may be questioned in the light of other tests on concrete pipe. Those most widely quoted, however, have been made on pressure lines in connection with water-supply projects, and no records of tests on concrete sewers as large as herein described and flowing part full have come to the attention of the writer.

Tests on 54- or 60-in. concrete pipe, running full and under pressure, made by F. C. Scobey on the Tulsa, Okla., water-supply project, showed values of n varying from 0.0106 to 0.0111 (*ENR*, May 28, 1925, p. 897). Other tests by Scobey on 54-in. concrete pipe, also running full and under pressure, on the Denver, Colo., water-supply conduit, showed values of n between 0.0105 and 0.0116 (*ENR*, April 29, 1926, p. 678). In those tests it was found that a section that had been in service for four years showed a lower value of n than an adjacent section in service only six months, the values being 0.0105 and 0.0116, respectively. This effect was attributed to the accumulation of slime on the pipe surface. A similar condition may occur in the sewer under discussion.

C. W. Sherman, in reporting a series of observations on 15- and 18-in. vitrified-pipe sewers, with velocities of 1.6 ft. per second, concluded that: "When allowance for deposits and for resistance to flow resulting from enlargements at manholes, changes of direction, entrance of branches, etc., must be considered, a value of n not less than 0.015 should be used in design. Since these factors are rarely absent, this value should generally be used." (*ENR*, Sept. 10, 1925, p. 435.)

It has been recognized for some time that the common hydraulic formulas are not strictly applicable to pipes flowing part full, that the capacity full is commonly greater than twice the capacity half full, and that the value of n is accordingly higher in partly filled pipes than with pipes flowing full. In the opinion of the writer, the difference in results of the tests herein described in detail and the tests above referred to is due primarily to the fact that in the first case the pipes were flowing approximately one-third full, while in the Tulsa and Denver tests the pipes were flowing full. The fact that one set of tests was on a sewer and the other set on water conduits is not believed to have any substantial bearing on this difference in results.

The writer was assisted in the tests by M. H. Klegerman and E. H. Sloboda, assistant engineers in the office of Alexander Potter.

FROM JOB AND OFFICE

Hints That Cut Cost and Time for the Contractor and Engineer

Laying Three 1,000-Ft. Pipe Lines Across a 45-Ft. Ship Channel

CONNECTING a new refinery of the Shell Petroleum Co. on the Houston, Tex., ship channel with the east Texas oil field required the laying of three 1,000-ft. welded pipe lines across a deep waterway in a trench 45 ft. below mean low tide. The two 8-in. oil lines and a single 4-in. pipe inclosing a telephone cable were laid out on the south side of the channel and the welding completed. A 24-in. collar was slipped over each welded joint, and this, in turn, was welded at each end to prevent any possible leakage. Each of the 8-in. lines was weighted with 24 river clamps.

The trench in which the pipes were laid was dredged to a maximum width of 60 ft. to prevent sand from filling it during the laying operation. It was extended 150 and 127 ft. beyond the channel limits on the north and south sides, respectively, to the property lines of the harbor, and then sloped up to meet the pipe-line approaches. The work of dredging required eighteen days.

Water traffic was suspended while the three pipes, with a total dead weight of 145,000 lb., were pulled across the channel. Five tractors on the south bank, where the lines were assembled, furnished the primary motive force; a sixth, on the opposite shore, was used mainly to guide the movement. Floating equipment used included four pontoons, two derrick barges and one flat barge.

The entire line, including the channel crossing, was laid by the Oklahoma Contracting Corp., Dallas. Dredging the trench was done by the Atlantic, Gulf & Pacific Dredging Co., Galveston.

Device for Heightening Levees Threatened With Overtopping

By JOHN B. DRISKO
Massachusetts Institute of Technology, Cambridge, Mass.

A METHOD of increasing the height of levees in danger of being overtopped, which is practiced successfully on the delta section of the Vistula River in Danzig, consists of a knockdown board cofferdam filled with earth or manure. The accompanying illustration shows the manner in which the units are built up to heighten the levee. The particular thing to be noticed is that the units are of knockdown construction and are used over and over, the parts being stored from season to season. The Danzig Dike Union now has in stock materials for raising 6 miles of levee from 20 to 24 in.

The floods in the Vistula, which flows into the Baltic Sea, are caused chiefly by ice jams. As the levee tops are frozen, holes have to be punched for the stakes that hold the cofferdams. A round timber punch shod with iron is driven down by long-handled wood mallets, and the stakes are driven tight into the holes. Construction

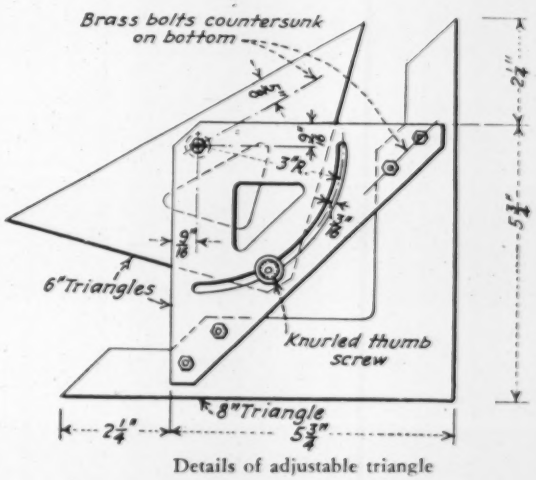
Building up and filling cofferdam units to heighten levee

then proceeds. The knockdown construction and long experience give remarkable speed of erection when emergencies arise. Storehouse for materials and tools are placed at strategic points, and several kilometers of levee can be heightened in a few hours.

A Useful Adjustable Triangle

By M. F. SPOTTS
Brown Steel Co., Columbus, Ohio

WHILE most draftsmen are familiar with adjustable T-squares, there are many occasions when more than one bevel is required on a drawing. For example, in detailing a truss the T-square would probably be used for the slope of the inclined chord and kept at this setting for the entire drawing. For the inclined web members a very useful tool is an adjustable triangle that will draw lines at any bevel and also at right angles to this direction without change of setting. It can be con-



Details of adjustable triangle

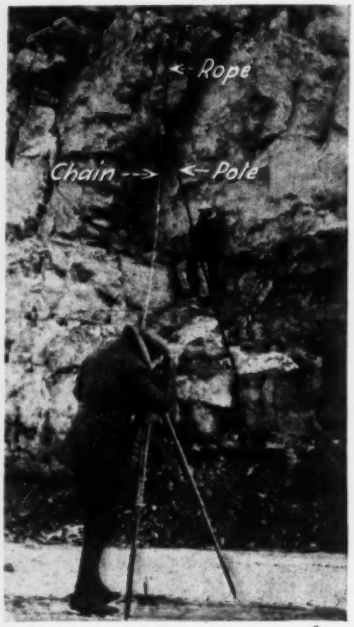
structed as shown in the accompanying drawing. This is made of three 45-deg. triangles, one 8 in. in size, the other two 6 in. The principal dimensions are shown in the illustration. Before cutting away a part of the large triangle it should be clamped, together with the stationary small triangle, to a piece of board and the holes drilled through both. A hole should also be drilled at each end of the curved slot, which is cut out with a scroll saw and smoothed with sandpaper. Small brass bolts are used in assembly, and all bolt holes are countersunk, that of the thumbscrew being square, instead of round, to prevent turning. A washer made of sheet brass should be placed just beneath the thumb nut and another between the two triangles, a third being used between the triangles at the bolt that serves as a pivot. After assembly, the ends of the screws should be burred over the nuts to prevent loosening.

Measuring Quantities in High-Bank Highway Construction

By ROBERT HINMAN
Hinman Bros. Construction Co., Denver, Colo.

IN COLORADO many highway projects through canyons necessarily involve excavation along high cliffs. Under such circumstances determination of excavation quantities by the conventional level rod and level method is usually impracticable, and frequently impossible. On a section of federal-aid highway built by the Colorado state highway department in the Colorado River Canyon, east of Grand Junction, a different method of crossing-sectioning was employed. This applied only to that part of the cross-section above the height of a level set up on the center line at each section. Below this point elevations were taken at the breaks in the cross-section in the usual manner. To secure the higher points, however, the level was replaced by a transit, successive shots being taken at the various changes in section. For each shot the vertical angle was read from the instrument and the slope distance read by means of a steel tape.

The method of holding the extended end of the tape varied according to the height of the cliff face. For comparatively short distances up the face of the cliff a rodman climbed a ladder and reached the remaining distance to the break with a pole. The distance could then be read directly by the transit man. When the face of the cliff was too high to measure by this arrangement, a second rodman on top of the cliff lowered a weight attached to a rope. The zero end of the tape was also attached to the weight, which could be stopped at any point on the cross-section. In the case of an overhanging ledge the rodman on top of the cliff lowered the weight as directed by the instrument man, while another rodman near the instrument shoved it into the overhang with a pole.



Cross-section shot under ledge

Zero end of chain attached to weight suspended from top of cliff. Rodman with pole forces weight back against face.

In plotting up the resulting notes it was simply necessary to lay off the height of the instrument above the center line of the section and to use this point as a center from which to lay off the vertical angle and distance recorded for each point on the cross-section.

Job and Office Notes

EXTENDING A DRAWING BOARD by fastening a hinged leaf along the top edge offers two advantages. When working on an unusually wide drawing the drop leaf serves as a flat extension. At other times the hinged leaf can be raised at an angle, forming a convenient mount for reference drawings that the draftsman needs to use at frequent intervals.—HERBERT STERLING, *Philadelphia, Pa.*

IN PLANNING THE REPAVING of a street surfaced with wood blocks it was necessary to obtain the exact elevation of the concrete sub-base at close intervals in order to estimate quantities for the new sub-base and asphaltic top. Removal of individual blocks would have left the street in bad condition and would have been a tedious job, as in most cases these were keyed together. The necessity was avoided by taking a broken spring-leaf from a 10-ton truck and cutting graduations in the edge; this wedge was easily driven down to the concrete base between the blocks, thus giving the exact information desired.—M. Y. CROWDUS, *City Enginering Dept., Nashville, Tenn.*

PATCHING SURFACE DEFECTS in underwater concrete is a difficult jub because a ball of cement or mortar melts in the hand as soon as it is taken under water. At the suggestion of Ted Mollineaux, diver, this problem was solved in one particular case in the following manner: Stiff blue clay was kneaded up with water until all the lumps were rubbed out, an equal quantity of fine sand was mixed in, and then cement was added a little at a time until about three times as much cement was worked up as there was clay. The result was a tough mass that could be handled and worked under water without dissemination. Rough tests made for strength, shrinkage and permeability all gave satisfactory results. The time required for setting was about double that normally required for the cement used.—M. N. JAMESON, Melbourne, Australia.

IN PREPARING tracing cloth for working, a mixture composed of 1 lb. of pulverized chalk and ¼ lb. of borax, rubbed on with a piece of chamois skin, is far superior to pure chalk.

To clean tracings and leave a surface as good as the original, sponge with benzine. This does not injure the cloth in the least, but will reestablish the color and remove pencil marks perfectly. When a compound has been used in erasing inked lines, sponging in this manner will clean and dry the affected portion and prepare it for re-use.

To clean a blueprint that has become dirty through handling, immerse it in 8 gal. of water to which has been added one tablespoonful of bichromate of potash. Wash in clear water both before and after immersion, and the print will be perfectly clean.

No matter how much a blueprint is overprinted, it can be restored to readable condition by giving it a slight bath in an alkaline solution of either borax, bicarbonate of soda, washing soda or ammonia.

Blueprints of telephone numbers that are called frequently are great time savers. They can be protected from wear in the following manner: Place the print between two sheets of very thin celluloid, then heat between two plates until the two sheets adhere to each other. The union of the sheets is so perfect that they appear as one, and the blueprint is afforded perfect protection.—CHARLES R. WHITEHOUSE, *Holtzer-Cabot Electric Co., Boston, Mass.*

Better House Construction and Financing Demanded by Home-Building Conference

Reports of 31 committees emphasize neglect of low-cost housing, persistence of inefficient design and construction methods, and burden of loans and taxation

BASIC TROUBLES and difficulties of the house-building industry were discussed last week at a three-day conference on home building and home ownership held at Washington on the initiative of President Hoover. In preparation for the conference, virtually every aspect of housing had been investigated by 31 committees in months of work; the results of these studies, a series of bulky reports, were laid before a gathering of more than 3,000, including architects, builders, engineers, realty men, mortgage and building-loan men, sociologists and domestic science experts. Five or six sessions were in progress simultaneously throughout the three days of the conference.

Broad Scope of Work—In addition to the committee reports, many supplementary papers were read, and in some sessions there was active floor discussion. The aggregate constituted an amazingly comprehensive mass of information and opinion on modern housing, ranging from landscaping to household management and from type of plumbing fixtures to mortgage interest rates. Plans are being made to publish the proceedings in a series of volumes.

Before the close of the conference it was recognized that housing progress depends on continued work. Several of the committees recommended the formation of a national housing institute, or of research and educational organizations. At the closing session it was announced that work will continue and that another conference will be called next year. It is understood that funds to support the work have been underwritten by private institutions. President Hoover, in opening the conference, stated that it had the purpose of promoting home ownership.

Better Methods of House Construction

Detailed study of how the admittedly "unsatisfactory practices" of house building may be improved was carried out by a committee made up largely of contractors and architects and headed by A. P. Greensfelder, president of the Associated General Contractors. It found that many obsolete methods continue in use, that proper coordination of the various groups of the building industry is lacking, and that the manufacturing industries are far ahead of building in organization of process. It recommended: (1) more attention to the construction of houses for families with income of $2,000 or less; (2) cooperative supervision and inspection bureaus to insure quality; (3) credit bureaus to protect all parties and eliminate liens or double payments; (4) more uniformity in building ordinances.

Detailed recommendations include: uniform estimating, cost-accounting and job-scheduling methods; group construction, with use of power where possible, as in excavation; designing to fit material sizes and standard grades; promoting better quality standards by educating the buyer, the builder and the worker; recourse to winter construction and, if necessary, change of leasing dates to make it effective; certification of material grades; use of prefabrication as far as possible; elimination of avoidable wastes in distributing and fitting; sound credit practices and seasonal discounts; care in storage and handling; reduction of fire and corrosion hazards; uniformity in arrangement and, as far as possible, in requirements and administration of building codes.

Prof. W. C. Voss in discussion emphasized the need for assuring better construction. He placed the loss in unnecessary repairs of poorly built houses at a billion dollars a year. Labor-saving methods in house building were opposed by M. J. McDonough, head of the building trades department of the American Federation of Labor. A speaker who appeared to be anti-labor said that bootleg wages are being paid in many cities with the connivance of union officials and criticized the committee for making no recommendation against "uneconomic wage scales." He also demanded reform of labor rules governing building.

Low-Cost Housing Deficient

Many of the reports asserted that low-cost housing, or the field of the small home, is backward. The design committee said that the design of the average small house is seriously defective, and that "most houses produced now are too expensive for all but 30 families out of every 100." The committee on business and housing declared that "it may not be practicable to provide under present living conditions satisfactory new homes for the lowest wage-earning group." The farm and village housing committee reported low standards in its field—farm-house values averaging $1,200 for the nation and ranging from $500 to $3,000 for different regions. Only 859,000 out of six million farm homes have either a piped water supply or electricity; in Mississippi less than 2 per cent.

Creation of limited-dividend housing corporations to develop large projects was urged by the committee on large-scale operations. Such projects could reduce costs 35 per cent and "bring new living quarters within the rent range of the great mass of our citizens."

The Financial Problem

Finance developed even more interest than construction. Most of the committee reports mentioned financing as an essential difficulty, especially second-mortgage loans. Three committees were directly concerned with the subject: income and the house (Prof. Niles Carpenter, chairman); taxation (Prof. Thomas S. Adams); and finance (Frederick H. Ecker).

Income—Studies of house-buying data in Buffalo and of various low-cost housing developments led the committee to conclude that "families receiving below $1,500

annually cannot afford new houses representing acceptable standards, but will be more satisfactorily located in used dwellings." However, the average income of wage and salaried workers in the United States is estimated at not quite $1,500 in normal years. Housing takes about 20 per cent of the family budget. The committee found that "many families are attempting to purchase houses at the expense of important elements of family economy." Specific points calling for remedy are bad financing and frequent premiums and bonuses for mortgage renewals.

Taxation—Asserting that property taxes are unduly concentrated in real estate (amounting often to 3 per cent of actual value, or $\frac{1}{6}$ to $\frac{1}{3}$ of gross rentals), the committee recommended shifting part of the tax burden to other subjects (incomes and securities) and reducing public expenditure. While necessary municipal expenditures are not likely to decrease, the states can do much toward eliminating waste by supervising local financing and by doing away with superfluous governmental units. The committee opposed special tax relief to home owners but demanded equitable assessment, citing Chicago as a bad case of variation (assessed values ranging from 1 to 100 per cent of sale value). Tax delinquencies and failure to enforce foreclosure are a growing evil.

Finance—"Much can and should be done to place home ownership on a sounder basis than exists today," the committee declared. Every home purchaser "should aspire to own his home ultimately in fee simple."

The committee recommended uniform mortgage forms and simplified foreclosure procedure. Long-term amortized mortgages should replace the short-term second mortgage. New financing methods or agencies to stimulate home building "would be helpful to their proponents and create a slight wave of benefit to unemployed artisans, but would only result in an increase of residences for sale in a market already demonstrably oversupplied, and would have an adverse effect on the already depleted values of existing homes."

Down payments on a home should be not less than 25 per cent, the committee stated. Central appraisal bureaus were recommended, but no recommendation toward higher quality of building was included. This led to a criticism by A. C. Holden, who told of a recent vain attempt to induce life insurance companies and other mortgage lenders to refuse loans on poor construction; their answer was that they are protected by conservative loan ratios and that it is not their business to look out for the social meaning of house construction.

Similar criticism was expressed in the report of the committee on design: "A decisive step toward improvement in design would be taken if the mortgage and building loan companies would finance only sound designs. The policy of most leading institutions with regard to design is extremely crude with the result that staggering losses have occurred."

A. K. Stern (chairman of the committee on large-scale operations) remarked that the report dealt only with the single detached house, "which is of another age." He complained that large-scale operations had received no attention from the finance committee. Other discussions called for means to help the home-owning family to sell when it must move to another city, for more knowledge of construction in lending organizations, for mortgage banks to make realty credit liquid, for removal of legal interest limits (now fixed by usury laws), for reduction of first-mortgage interest to 4 per cent, and for better recognition of building and loan associations.

Prof. Richard T. Ely suggested that land be taxed on use rather than on appraised value. Prof. H. D. Simpson declared that the long way to improvement is to reform the property tax; the short way is to depart from excessive property taxation by using income, sales and excise taxes to produce one-third to one-half the revenues.

Technological Possibilities

"The building of small houses has not made the progress found in other industries supplying household necessities," said the committee on technological research (Dr. George K. Burgess, chairman). It suggested that cost can be reduced greatly by increasing the amount of shop fabrication, even to sections of wall, floor and roof.

The report referred to wall construction of rammed earth as a favorable possibility; a separate paper described one such house, built near Washington a few years ago, whose walls cost $8 per cubic yard, exclusive of stucco and plaster (both applied directly to the earth).

Many other committees dealt with matters of engineering concern. A few brief notes on their activities follow.

Planning, Decentralization and Utilities

Planning and Zoning—More attention was urged to housing on the part of planning commissions, more active municipal planning, development of self-contained "neighborhood units," installation of utilities on all subdivisions and more open development of residence areas, with 25 per cent maximum land coverage in one- and two-family districts.—F. A. Delano, chairman.

Subdivision Layout—Rectangular patterns are most expensive. Bad plats should be disapproved by the city plan commission. Land buyers should investigate plan and platting and insist on complete installation of services. Neighborhood units best.—Harland Bartholomew, chairman.

Utilities—Service installations (which are about 20 per cent of the house cost) do not control the spacing of houses. Joint use of trenches (water and gas, electric and phone, sewers) can reduce cost 15 to 20 per cent. On wide streets two street mains, one on each side, are economical. "Generally the cost of advance installation, necessary for complete avoidance of subsequent cutting into pavements, would be prohibitive."—Morris Knowles, chairman.

Industrial Decentralization—Favored industrial village communities. Movement of industries to small towns has been deterred by a rate structure "that has strongly tended to force industry to locate in large centers," and by the absence of housing. Centralization of industry is still in progress, but the social order is best served by decentralization. Recommends research into decentralization and the housing problems connected with it.—Stuart W. Cramer, chairman.

House Design and Equipment

The essentials of good housing can be provided in any type of dwelling. "If there were no profit to the developer in land, overcrowding, one of the most serious counts against the multiple dwelling and the row dwelling, would probably disappear." The population group with income from $1,800 to $2,200 should be taken as the objective in planning for improved housing. The two-family house is losing popularity in most cities. Apartments are temporary abodes. Maintenance of a proper proportion of one-family houses will be aided by requirements that

multiple dwellings have large courts.—Types of Dwellings, John Ihlder, chairman.

Group planning is necessary and logical. The architect should interest himself more actively in the design of the small house; good stock plans are an essential. Cooperation to secure good design should go further in the building industry, and realtors as well as building material distributors should concern themselves with good design.

Typical detached six-room two-story houses 24x26 ft. cost from $6,000 to $8,000. Structure and finish cost 65 to 75 per cent of the total. Mechanical-equipment costs are tending to increase. The bungalow is more costly than the two-story house of the same volume (about 20 per cent more in some cases). Semi-detached construction saves 20 to 25 per cent of the cost. "The sound standard $5,000 house is being built less and less. Only the small apartment suite of three to four rooms and small bungalows in rural districts can be purchased at this figure."—Design, W. S. Parker, chairman.

Blighted Areas—District replanning was advised by the committee on blighted areas and slums (A. S. Garfield, chairman) as the best method of dealing with blighted areas in cities. City and private cooperation is necessary in such work, but at best the financing will be a prime difficulty. Such rebuilding is believed to be a proper subject for exercise of condemnation powers.

LETTERS TO THE EDITOR

Solar Meridian by Stopwatch

Sir—The azimuth method described in the Sept. 10 issue of *ENR*, p. 420, and criticized Oct. 22, p. 666, utilizes the greater precision of the stadia wire interval, accurate to the nearest second of arc, on the standard transit whose circle graduations measure only the nearest minute of arc, the limit justified by the plate bubbles. It also presupposes accuracy to the nearest tenth of a second in time, which in my experience can only be assured by another type of eyepiece recording the average of several wire crossings.

The derived formula is No. 271 of Chauvenet's Trigonometry, 1854 edition, p. 239, and is tabulated for general values of L and Z on p. 318 of Hydrographic Office Publication 200.

In your quoted example the azimuth is computed to the nearest minute of arc, which corresponds to .07 sec. of time, although the declination change during the 240.2 sec. elapsed time of the observation lengthens the 94-deg. side of the $P\ Z\ S$ spherical triangle about 4 sec. of arc, or 0.26 sec. of time.

The probable error of a single unchecked reading may be easily avoided by repeated pointings at equal time intervals, checking the increments. Guessing at bisection of the sun disk is ample for a standard transit and time to ± 2 sec. For example:

Watch	Z	dZ	h	dh
4 : 03 : 00	276 03′		31 10′	
		04′		13′
: 04 : 00	276 07′		30 57′	
		05′		14′
: 05 : 00	276 12′		30 43′	
		04′		13′
: 06 : 00	276 16′		30 30′	
		04′		15′
: 07 : 00	276 20′		30 15′	

In spite of individual discrepancies, the middle observation of this series is reliable on both horizontal and vertical circles. Furthermore the motion in altitude, being about three times as fast as in azimuth, is favorable to an altitude formula.

For quick field computation I prefer a slide rule like the Ross Meridiograph (*Engineering News*, Feb. 16, 1914), though mine is subject to a maximum error of ± 4 min. The formula $-\cos Z = \tan h \tan L + \sec h \sec L \sin D$ is solved by two settings and a third scale reading. Recomputation by tables does not involve much work.

Although time to the nearest second is now available by radio and longitudes should be as accurate as latitude determinations, the uncertainties of refraction and a 1-min. transit fail to give me accurate results. To be accurate to the nearest minute, I prefer a 10-sec. instrument with a striding level. Why certain makers put a vernier reading to single seconds on transits that cannot be leveled closer than 40 sec. is unexplainable except as a talking point.

ROBERT H. MERRILL,
Consulting Engineer.

Grand Rapids, Mich.,
Nov. 2, 1931.

Sir—In *Engineering News-Record* of Oct. 22, p. 666, there was a letter from R. R. Robertson relating to my article "Solar Meridian by Stopwatch."

If Mr. Robertson would only realize that even when the sun is near the equator, the greatest hourly change is only 0.97 min., while the time for making the observation is only a few minutes, he would see that in the practical application of the calculus the declination can be considered constant. Even if it were desired to introduce such mathematical refinement, it is apparent that during the time of observation the change in declination would hardly amount to more than 5 sec. of arc, which would require a correction in the observed bearing of one-half this amount. An attempt at such accuracy is unjustified in any field observation.

The writer, who has used this method extensively, finds it extremely reliable under all conditions.

JAMES GIRAND, JR.

Oct. 29, 1931.
Phoenix, Ariz.

Exact Analysis by Repeated Approximations

Sir—In your Nov. 12 issue John E. Goldberg presents an article entitled "Vertical-Load Analysis of Rigid Building Frames Made Practicable," which is both interesting and instructive. Mr. Goldberg is quite right in his statements that the correct analysis of almost any continuous frame will show that the one-tenth and one-twelfth coefficients are far from satisfactory and that the desirability of a practicable method of rigid-frame analysis is unquestioned.

The method of analysis presented is both simple and elegant and has much to commend it, but I think the statement is rather broad that "no approximate method is so easy, so direct and so sure of final accuracy as this simple solution based upon the correct slope-deflection equations."

As a matter of fact, the method is not an approximate one. It is an exact method, using successive approximations to obtain the result, the accuracy of which depends upon the user's wishes. The process is that of solving a series of normal simultaneous equations by successive approximations.

The method of analyzing continuous frames by distributing fixed-end moments, published in the *Proceedings* of the American Society of Civil Engineers, May, 1930, by Prof. Hardy Cross, of the University of Illinois, is somewhat similar in that it, too, is an exact method, if exactness is desired, the result being obtained by successive approximations. Both methods are based on the same simple underlying principles. The beauty of Prof. Cross' method is that it allows the user to visualize what is happening to his structure. He can think of each step in the solution as a physical occurrence. The same cannot be said of the method presented by Mr. Goldberg. Prof. Cross' method is more readily retained in the memory, especially when one uses the methods infrequently.

In applying this method of analysis, I do not think that the clear length should be used for the length of the member. The slope-deflection equations are developed using the length of a member as center to center of supports. It is true that many building codes specify that the span length for continuous or restrained beams built to act integrally with supports shall be the clear distance between faces of supports, but this length is for use with the moment coefficients and not with an accurate method of analysis such as that presented by Mr. Goldberg.

ORRIN H. PILKEY.

New York City,
Nov. 25, 1931.

NEWS OF THE WEEK

Low Prices Prevail on Texas Highway Work

The Texas state highway commission has awarded 259.8 miles of new roads, eleven bridges and one grade-crossing elimination at a bid cost of $1,781,378, about $300,000 less than was estimated. The commission also called for bids approximating $1,400,000 to be received and awarded later.

Bids received at this meeting were among the lowest ever received by the commission. The lowest price ever bid on concrete pavement was received, 93c. a square yard. This compares with prices of more than $2 two years ago and well over $1 this year up until this letting. However, some of this differential in price was due to cheaper processes that have been developed by the highway department. Some jobs were bid at nearly half the estimated cost.

Temporary Relief From Drought Conditions in Southeast

Temporary relief from drought conditions that have been experienced for several months in practically all of the southeastern part of the country was afforded last week by rains over most of the more seriously affected areas. Precipitation in those areas ranged from 2 to nearly 5 in. Coming in the form of slow, gentle rains on soils that were thoroughly dry to unusual depths, percolation was relatively great. Most streams on which large hydro plants are located rose enough, however, to permit reduction in the use of steam reserves for the time being.

Municipal and industrial water supplies that had begun to feel the pinch seriously also were replenished sufficiently to take care of current demands. But competent observers are convinced that unless the amount of rainfall in the Southeast between now and summer is far in excess of normal for that period, the shortage of water in the fall of 1932 will be greater than the all-time minimums recently recorded on many streams in that part of the country.

New York Engineer Relief Work Making Good Progress

Encouraging progress is being made by the engineers' committee on unemployment in the New York metropolitan district. Cash contributions to the relief fund amounted to $27,856 up to Dec. 7, and pledges of $10,318 bring the total to more than $38,000. This, however, is 20 per cent of the goal of $200,000.

Work has been found for 196 of the 765 men registered at the New York office, and sub-committees have found work for 52 men in Westchester County and five in New Jersey. The New Jersey committee is only recently organized. Most of the men placed have gone into city departments; some on a traffic survey, some as plan examiners and as specification writers, and others on a park survey in Brooklyn. Reconstruction work in the hydraulic laboratory of the College of the City of New York has taken a few men and still others have been set at chart making for New York University.

Work for twenty men has been found at headquarters of the Second Corps checking and bringing the Governors Island Post maps up to date.

Department stores have taken seventeen mechanical and electrical engineers into their toy departments simply to provide work. As these are considered non-competitive positions, the committee pays half and the stores half the salaries of the men employed.

Some men not in need of immediate relief are attending the lecture courses opened to them at Columbia University.

Santa Monica, Calif., Rejects Bond Issue for New City Hall

Two bond issue proposals totaling $950,000 for a new city hall for Santa Monica, Calif., were rejected by voters at a municipal election Dec. 1. A third proposal calling for expenditure of $30,000 as a preliminary to purchase of a civic center site also was defeated. William H. Carter, civil engineer and former commissioner of public works in Santa Monica, was elected commissioner of public safety and mayor.

Owyhee Dam Nearing Completion

The Owyhee dam was 90 per cent completed and seven months ahead of schedule when concreting was discontinued for the winter on Nov. 23, according to the U. S. Bureau of Reclamation. Some of the roadway paving at the top of the dam has been finished. When work is resumed in the spring an automatic electric elevator of 9,000-lb. capacity and having a lift of 270 ft. will be installed.

About 2,000 ft. separates the headings of 3½-mile tunnel No. 1, which leads from the reservoir to Tunnel Canyon. The driving of the outlet of tunnel No. 5 and lining of the inlet end are progressing satisfactorily.

On Dec. 23 bids will be received at Nyssa on 4½ miles of canal work between Tunnel Canyon and Owyhee River. This work will include three tunnels, 530, 1,357 and 439 ft. in length.

Supreme Court Forbids Garbage Dumping by New York City

Accepting the report of its special master, Edward K. Campbell, in every particular, the U. S. supreme court on Dec. 7 issued a decree directing the city of New York to cease dumping garbage and refuse at sea by June 1, 1933, and in the meantime to reduce the quantity so disposed of as much as possible by the efficient operation of existing incinerators. As noted in *ENR*, Dec. 3, p. 901, compliance with this decree involves the immediate construction of four 750-ton incinerators by the city, with the subsequent addition of ten more to care for estimated requirements until 1945.

Semi-annual reports giving the progress of construction and the amount of refuse still being dumped must be submitted to the court until the practice is eliminated.

The decree is the result of a suit brought by the State of New Jersey to prevent the pollution of its bathing beaches by floating refuse. On May 18, 1931, the court decided this suit in favor of the plaintiff (*ENR*, May 21, p. 869) and directed the special master determine the length of time necessary for the construction of incinerators and to report his findings. The present action is the result. All costs of the suit have been assessed against the city of New York.

Austin Dam, on Colorado River, to Be Rehabilitated

Judge Duval West, of the federal district court at Austin, Tex., has approved an agreement between attorneys for the city and Austin Dam, Inc., present holder of the franchise for the power dam on the Colorado River here granted to William D. Johnson in 1911. The agreed judgment ends sixteen years' litigation. It provides that the dam and its appurtenances become the property of the city of Austin, and that Austin Dam, Inc., spend $1,500,000 in the rehabilitation of the structure.

The city secured the following equities under the agreed judgment: absolute title to the dam, cancellation of the contract originally granted to William D. Johnson, rehabilitation of the dam without cost to the city within two years and operation of the structure within four years, and the right to use Lake Austin for recreational purposes.

Austin Dam, Inc., is granted the lease to the dam and its properties for 40 years, in return for which the company is obligated to supply the city without charge 4,000,000 kw.-hr. of power a year.

Construction League Outlines Its Policy and Advances Plans

DEFINITE progress was made by the recently organized Construction League (*ENR*, Oct. 8, 1931, p. 585) at a meeting on Dec. 2 of the league's policy committee at the headquarters of the American Institute of Architects, Washington. The committee, which is the directing organization of the league, took action which placed the league on a more effective working basis as to structure and methods, assigned specific subjects to the working committees, and recommended to the favorable consideration of its member bodies four proposals put forward by members and indorsed by the committee. Robert D. Kohn, president of the American Institute of Architects and president of the league, presided at the meeting.

The committee decided that a construction library should be formed, to be housed temporarily at the A.I.C. headquarters, where the general secretariat is also located. All component organizations will send to this library their publications pertinent to construction. It was also decided to recommend to member bodies that publications falling in the field of the league be printed in uniform size, 8½x11.

To Issue Monthly Bulletin

On motion of A. P. Greensfelder, it was decided to issue a monthly bulletin under the title *Construction*. If feasible this bulletin is to include statistical facts and analyses of construction, a problem to be worked out by the league's research committee. Dr. John C. Gries and D. H. Sawyer, of the department of commerce, were elected advisers of the league.

Proposals indorsed by the league committee and recommended to member bodies for their support are: (1) continuation of the government's construction census; (2) promotion of a safety platform for the construction industry; (3) promotion of public and quasi-public works by the issuance of state, local and national bonds; and (4) the single-price system of bidding.

Committee Work Allotted

Various subjects were referred to the league's committees for study and report. To the policy committee: government in business, plans for community construction, and construction stabilization. To the plan committee: decentralization tendencies in housing and industry; renovation of blighted districts. To the employment committee: feasible methods of minimizing unemployment. To the correlation committee: the single-price system as a deterrent to bid peddling, and the advisability of regularizing contract payments by establishing a ten-day cash discount. To the research committee: study of the work of the Bureau of Standards on construction materials and listing of research agencies in this field. To the merchandising committee: methods of marketing, financing and unified publicity for the construction industry. To the public relations committee: cooperation with the construction division of the U. S. Chamber of Commerce on inter-industry problems, prison labor, prequalification, state licensing and registration bills, model lien laws, and means of making effective the work of the Home Building Conference. It was decided tentatively to hold the next meeting of the committee in conjunction with a meeting of the assembly at St. Louis in the last week of March, subject to other call of the chair. Various individual organizations of the construction industry have already planned to meet in St. Louis at the same time.

Latest Radio City Plans Discussed at Adult School

THE huge coordinated building project known as Radio City, which is actively under way on the three blocks bounded by Fifth and Sixth Aves., 48th and 51st Sts., New York City, was described in its latest phases by Raymond Hood, one of the architects, at a meeting Dec. 3 in the New School for Social Research, the lecture being one of an adult educational series on the general subject of "Present Day Problems of Architecture, Construction and City Planning."

Changes in Plans Outlined

Since the Radio City development was announced last spring (*ENR*, March 12, 1931, p. 455) planning has crystallized to a large degree, resulting in several important changes, the most noticeable being the elimination of an oval-shaped building on the Fifth Ave. front and the substitution therefor of two six-story rectangular buildings forming a gateway into an interior sunken court in the center block, immediately east of the 60-story office building that forms the central unit of the five skyscrapers in the group. Exits from this court, said Mr. Hood, will lead to an underground plaza beneath the entire three-block development. Between the sunken court and the central office building a new street is planned to cut through the three blocks of the development.

Structural Simplicity

The central building is characterized by extreme structural simplicity, the elevator and service areas forming a core in-

(*Continued on page 944*)

WESTERN HILLS VIADUCT, CINCINNATI, OHIO

This double-deck structure, 3,500 ft. long and crossing Mill Creek Valley and the approach to the new union station, will be completed in the spring of 1932. The old Harrison St. viaduct, seen in the middle foreground, will be removed. The cost of the viaduct will be divided among the city, the Cincinnati Union Terminal Co. and the Baltimore & Ohio Railroad, the last named owning the two main railroad lines to be seen flanking the Mill Creek arch.

Engineers Discuss Hydraulics and Track Stresses

THREE papers of special interest to civil engineers were presented and discussed at the annual meeting of the American Society of Mechanical Engineers held in New York Dec. 6-11. Two of the papers dealt with hydraulic problems and one with stresses in railroad track.

The first of the two papers on hydraulics was a summary of recent developments in the manufacture and use of hydraulic butterfly valves, by Ross L. Mahon, vice-president and general manager of the Pelton Water Wheel Co., of San Francisco. With the increase in size of the hydraulic turbines that has taken place in recent years and the ever-increasing demand for maximum efficiency, more and more attention is being given to methods of controlling the flow of water to the turbines. This, according to Mr. Mahon, has resulted in numerous refinements in the design of the butterfly valves both as to hydraulic characteristics and ease of operation and as to making them watertight. This progressive development has resulted in the construction of butterfly valves up to a diameter of 27 ft., that used at the Conowingo plant of the Susquehanna Power Co.

Discussion of this paper centered largely around the operating problems involved in such large valves. It brought out the need for keeping leakage down to a negligible amount where such control valves are used, especially where hydro-electric plants are held in reserve for peak-load demand, as is the case on most systems where both steam and hydro-electric plants are in use.

Piezometer Investigations

The second of the hydraulic papers was a summary of a very comprehensive investigation of piezometers conducted in the Alden hydraulic laboratory, Worcester Polytechnic Institute, by C. M. Allen, professor of hydraulic engineering at that school, and by L. J. Hooper, of the laboratory staff. The object of the investigation was the determination of a standard piezometer for commercial use and the study of the hydraulic effect of various conditions of operation upon different forms of piezometers. Many types of piezometer plugs and orifices were tried out and a number of the factors affecting the performance of piezometers were analyzed. In presenting the paper Prof. Allen stated that he had been led into undertaking the tests on account of the lack of fundamental information concerning piezometers and the need for a thorough determination of such fundamentals because piezometer readings are made the base of so many studies where the measurement of fluids is involved.

In discussing the paper John R. Freeman stated that about 50 years ago he made similar studies under the direction of Hiram F. Mills in which some 6,000 readings were taken. In the Mills study an open flume was used instead of a closed pipe, as in the case of the recent studies at Worcester. Unfortunately, Mr. Freeman stated, the results of the studies conducted for Mr. Mills were buried in the *Transactions* of the American Academy of Arts and Sciences in Boston and never have been made available to engineers.

W. M. White, chief engineer, Allis-Chalmers Mfg. Co., characterized the work of Prof. Allen and Mr. Hooper as of fundamental importance to hydraulic engineers and stated that on the assumption that Mr. Freeman's studies for Mr. Mills were of equal importance, it was to be hoped that Mr. Hooper will unearth the Freeman studies and correlate them with the results obtained in the paper under discussion.

In Mr. White's opinion the observations as to conical piezometers in the Allen-Hooper paper are among the most valuable data presented therein. Mr. White outlined in detail studies made in his plant on the use of conical piezometers. While he does not believe that the negative pressures obtained thereby can be used yet to amplify readings in hydraulic measurements, he does feel that the results so far obtained indicate a new field of study, especially toward increasing the efficiency of turbines and pumps.

Track Studies

In a paper on stresses in railroad track, S. Timoshenko, professor of mechanical engineering, University of Michigan, and B. F. Langer, mechanics division, Westinghouse Research Laboratory, outlined a method for experimental determination of stresses in railway rail developed by the engineers of the Westinghouse Electric & Mfg. Co. in connection with a study of the tracking characteristics of electric locomotives. The studies are stated by the authors to be a further extension of the important work carried on by the special committee on stresses in tracks under the direction of Prof. A. M. Talbot. So far as the authors know, their studies of local stresses produced by vertical and lateral forces in the rails are the first of that character to be made. From the result obtained, the authors conclude that the weak points of present rails are the fillet under the head and the head itself.

Los Angeles Engineer Employees Gain Slight Respite

Through the generosity of fellow employees, 98 technical workers in the city engineering department of Los Angeles, Calif., scheduled to be laid off Dec. 1, will be continued on the city payroll until Dec. 31, under an action approved by the city council. All employees of the bureau of engineering will donate 1½ days' salary during December to pay them.

Latest Radio City Plans Are Discussed

(*Continued from page 943*)

closed in a corridor around which office space, 27 ft. deep from the windows, with no interfering columns, is grouped. The long axis of the building runs east and west. Wind bents in a north and south direction are uninterrupted and contain generally six columns, two in the exterior walls, two in the corridor partitions and two in the walls of the elevator shafts. As low-rise elevator banks are discontinued at the 15th, 30th and 45th floors, the corners of the building rectangle are set back, always maintaining the 27-ft. width from window to corridor wall.

In the north block, between 50th and 51st Sts., and fronting on Sixth Ave. will be a 31-story office building. East of this will be the International Music Hall, seating 6,100 persons, and still farther east across the new street will be a 45-story office building. The south block, between 48th and 49th Sts., will be provided with a layout closely symmetrical to that in the north block except that the theater, a sound-picture enterprise, will seat only 3,500 persons. Space is also reserved in this block for the Metropolitan Opera Co.

The plan for an extensive parking garage beneath the development has been abandoned, as contributing unnecessarily to congestion. Instead, comprehensive studies are under way looking toward pedestrian subways or possibly moving platforms to connect the development with various city subways, other shopping and business centers and perhaps railway terminals. Studies of plans for landscaping the roofs and terraces of the various buildings (about seven acres in all) include the use of fountains and waterfalls as well as trees and shrubs, to the end that the usual view of bare roofs seen from the upper floors of tall buildings may be eliminated.

Criticisms Answered

Mr. Hood took considerable pains to answer some of the criticism that has been showered on the project, first pointing out that it is a commercial enterprise; Columbia University must realize a substantial part of its income from leaseholds on the property. The architects feel that the stagger plan of arranging the five tall buildings is a proper and forward step in assuring a maximum of light and air and that these structures do not in any way load the site down with too many buildings. It is estimated by the architects that a permanent population of between 100,000 and 125,000 can be accommodated and that an additional floating population of 75,000 may enter the various buildings every day.

Mr. Hood argued in favor of congestion in cities, if congestion means grouping of businesses in a small area as exemplified by the Grand Central zone in New York. As against the many dark courts upon which many Paris business offices front, Mr. Hood

prefers the skyscraper with its light, air and congestion, though he admits that skyscraper development and segregation of businesses in groups of skyscrapers make elaborate and effective transportation facilities imperative. Radio City, said Mr. Hood, represents the first instance in which capital has joined with real estate in the sense that it has previously joined with steel and automobile production. Previously capital has been interested in real estate only as a lender of funds. For this reason the architects feel that in Radio City they have a special obligation to the building industry in making this first venture financially successful.

Present Status of the Work

The present status of the work was not touched upon by Mr. Hood, but it may be said that actual work on the project started in May, 1931, with the demolition of buildings on the site. Excavation work on the western half of the north block (site of 31-story office building and International Music Hall) has been completed by Clarence L. Smith, Inc., and most of the 220 concrete footings have been completed. Derricks of Post & McCord, the steel erectors, are setting grillages. John Lowry, Inc., is the general contractor. Excavation of the site of the central office building is about two-thirds completed by George J. Atwell Co. Hegeman-Harris Co., Inc., is the general contractor. In the south block the Gahagan-Canavan Corp. has finished the excavation and is pouring footings for the sound picture theater; Barr, Irons & Lane, Inc., is the general contractor.

Radio City is being built by John D. Rockefeller through the Metropolitan Square Corp., and its builders, the Todd, Robertson, Todd Engineering Corp. and Todd & Brown, Inc. The architects are Reinhard & Hofmeister, Corbett, Harrison & MacMurray, and Hood & Fouilhoux.

Other Lectures in the Course

The series of lectures of which this one on Radio City formed a part have been arranged by Albert Mayer, New York builder. Other subjects which have been presented since the lectures began on Oct. 1 have included the Empire State Building, by William F. Lamb, Andrew J. Eken and Robert C. Brown; foundations, by C. S. Proctor; structural steel design, by J. W. Pickworth; building economics, by Albert Mayer; elevators, by Bassett Jones; windowless factories, by F. M. Gannett, of the Austin Co.; and acoustics, by G. T. Stanton. Future lectures will include Port Authority planning, by Howard S. Cullman, and town planning, by Clarence Stein. The lectures were planned primarily to acquaint the layman with the problems, methods and meaning of present-day building, to give him an opportunity to ask questions and take part in the discussion. Starting with individual building projects and problems, the subjects have now approached the broader questions of group planning and city development.

WASHINGTON NOTES

By PAUL WOOTON

Washington Correspondent

Investigation of Conditions on Flood-Control Work Asked; Doak Upholds Davis-Bacon Law

AT THE SUGGESTION of local communities in the lower Mississippi Valley, Representative Collier, of Mississippi, has asked the war department if it is possible to do a larger proportion of the flood-control work with government forces instead of letting the work out under contract. Higher wages are paid and more local materials are purchased when the army engineers do the work directly by hired labor, Mr. Collier states.

Meanwhile additional complaints are being received by the war department concerning working conditions on levee contracts. It has been charged by field representatives of the American Federation of Labor that virtual slavery exists in the contract camps. Specifically, the complaint is made that the negro workers are flogged, are worked excessively, and are underpaid. The conciliation service of the labor department has not yet been asked to intervene but is watching the situation with interest.

The Mississippi Valley flood-control branch of the Associated General Contractors has denied that there is any substance to the charges of the labor representatives. R. G. Church, secretary and manager of the valley branch of the contractors' organization, terms the charges "another gesture of the labor group to discredit all classes and kinds of employers of labor in their program to unionize the South." The contractors are willing to have investigations made of their payrolls and the conditions under which the men live and work, he stated.

Asks Investigation of Wages on Public Building Contracts

As a result of complaints that workers on public building contracts are being forced to rebate part of their wages to the contractors, Senator Wheeler, of Montana, has announced his intention of calling for a complete investigation to ascertain if the purpose of the prevailing wage act is being defeated by such practice. He states that a specific instance of a forced rebate of wages on one of the building projects in Washington has been brought to his attention. In many other cases workers on public building projects are forced to take lower wages than is indicated by official records, Senator Wheeler has been informed, and he believes that such practice if allowed to continue will eliminate responsible contractors from government work.

In his annual report to the President, Secretary of Labor Doak states that the Davis-Bacon prevailing wage law has had a beneficial effect upon industry generally throughout the country. He believes that most contractors have endeavored to comply with the provisions and takes the position that it is an eloquent testimony of the disposition of contractors to comply with the act that he has been compelled to determine the rate in only one case.

No specific cases of forced rebate of wages have come to the attention of the labor department. Investigation of rumors that this practice has been indulged in on certain projects invariably has shown that nothing improper was being done.

Hoover Dam Notes

Driving from six headings in the 41x56-ft. tunnels, a total of 566 ft. of work was done on the Hoover Dam project during the week ended Nov. 28. Stripping operations and portal excavation continue at the inlet of tunnel No. 1 on the Nevada side. Some work is being done at the outlet of that tunnel and the vertical face is being cut out for the inlet of tunnel No. 3 on the Arizona side.

Cold, wet weather has delayed somewhat the work on the Black Canyon highway.

Six Companies, Inc., during the week added 200 men to its payroll. This brings the total working force to 3,100.

Owners of lands that will be drowned out by the reservoir are being advised of the appraised value of their holdings and requested to submit proofs of ownership.

At Boulder City rough grading of streets and the areas to be devoted to public parks is nearing completion. A total of 9,500 sq.yd. of macadam base has been laid on streets. Twenty per cent of the concrete sidewalks has been laid and 8 per cent of the gravel sidewalks. The administration building is 55 per cent complete, the dormitory 74 per cent, the municipal building 60 per cent, the water-distribution system 94 per cent and the sewer system 93 per cent complete.

The assessor of Clark County, in which Boulder City and the government reservation are located, has announced that unless the New Mexico Construction Co., holding Boulder City street contracts, conforms to the Nevada poll-tax law legal steps will be taken to collect the tax. An injunction was recently granted by the federal court restraining Nevada from enforcing state tax and mining laws against Six Companies, Inc., but the county assessor holds this does not apply to other contractors on the project.

Baltimore's Airport Plans

Under the direction of Bernard L. Crozier, chief engineer of Baltimore, a survey will be made of Logan Field, the city's temporary airport, and recommendations made to put the field into first-class condition. The survey will be made by Louis M. Rawlings, who has been appointed city airport manager.

Ohio Court Decision on Bonds Delays Columbus Sewage Plant

A recent decision of the Ohio supreme court holding that bonds issued to finance sewage-disposal projects must be within the 15-mill limit or must be approved by vote of the citizens before they are legal may result in delaying the construction of the proposed $3,500,000 sewage-disposal plant at Columbus for a year. The decision leaves two alternatives, one of which is the "tap" system, and the other is to submit a bond issue to the vote of the people. The tap system, which is used in Dayton, Ohio, provides for levying charges against property owners for sewer connection. This is opposed by Henry Worley, who will become mayor on Jan. 1. Under Ohio laws the bond issue can be submitted only at the November election and this will probably be done next November.

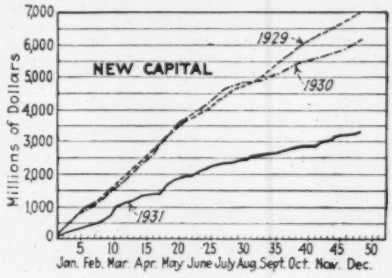
Kentucky Acts to Stop Bootlegging of Gasoline

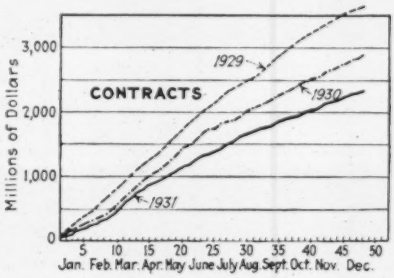
The State of Kentucky is starting a movement to block bootlegging of gasoline, on the theory that it is cutting down funds available for highway work by $850,000 annually. Sales of 170,000,000 gal. annually are reported, with a state highway tax of 5c. a gallon. It is believed that at least 10 per cent more gas is being consumed, on which the state obtains no tax.

Capital and Contracts

The total of new capital issued, for the entire country, in the week ended Dec. 5 was $19,000,000, only $3,000,000 of which went for public construction. In the first week of November $40,000,000 in bonds were floated, while for the same period of December, 1930, new capital issues totaled $73,000,000.

Cumulatively, the total for the period Jan. 1 to Dec. 5, 1931, is $3,350,000,000, compared with $5,877,000,000 in the corresponding part of 1930.





COSTS AND CONTRACTS

ENR Index Numbers

	Cost			Volume	
Dec. 1,	1931	166.23	Nov.,	1931	180
Nov. 1,	1931	169.28	Oct.,	1931	229
Dec. 1,	1930	196.86	Nov.,	1930	207
Average,	1930	202.85	Average,	1930	260
Average,	1929	207.02	Average,	1929	317
1913	.....	100.00	1913	.....	100

This Week's Contracts

Heavy construction contracts, reported by *Engineering News-Record* in the week of Dec. 10, with some comparisons, total as follows:

(In Thousands of Dollars)

	Dec. 10, 1931	Average of Last Four Weeks 1931	1930
Buildings:			
Industrial	$1,063	$2,092	$3,150
Other	10,919	9,388	17,590
Streets and roads.	6,567	5,603	7,420
Other construction.	6,468	15,953	12,343
Total	$25,017	$33,037	$40,504

Total, all classes, Jan. 1 to Dec. 10:
1931 ..... $2,381,918
1930 3,085,113

Connecticut River Improvement Is Disapproved

Engineers of the U. S. war department have disapproved the plan for the improvement of the Connecticut River to provide a navigable channel between Hartford, Conn., and Holyoke, Mass. The specific proposition was the construction of a dam at Enfield, Conn., which the federal engineers estimated would cost $5,238,000. The government experts estimate that the cost of the completed project would be about $5,238,000 and that this expenditure would not be justified by the returns to be received.

SOCIETY CALENDAR

AMERICAN ROAD BUILDERS' ASSOCIATION, Washington, D. C.; annual convention and road show, Detroit, Mich., Jan. 9-15.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; annual meeting Jan. 19-22, New York City.

AMERICAN WOOD PRESERVERS' ASSOCIATION, Chicago; annual meeting, St. Louis, Jan. 26-29.

NATIONAL CRUSHED STONE ASSOCIATION, Washington, D. C.; fifteenth annual convention and exposition of quarry equipment and machinery and supplies, Pittsburgh, Pa., Jan. 19-22.

NATIONAL PAVING BRICK ASSOCIATION, Washington; annual meeting, Chicago, Feb. 10-12.

NATIONAL SAND AND GRAVEL ASSOCIATION, Washington; annual meeting, Pittsburgh, Jan. 27-29.

AMERICAN SHORE AND BEACH PRESERVATION ASSOCIATION held its annual meeting in Washington on Dec. 7. Papers were read by Marcel Garsaud, member of the Federal Power Commission, on "Public Control of Beaches—Advantages and Pitfalls"; by Col. Earl L. Brown, U. S. Army, district engineer, New York City, on "Inlet Improvements"; by J. Spencer Smith, president of the association and president of the New Jersey State Board of Commerce and Navigation, on "Protection of Coasts Against the Sea"; by Thomas J. Pancoast, president, Miami Beach Chamber of Commerce, on "The Development of Miami Beach." There were also round-table discussions on activities in various states.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE will hold its winter meeting in New Orleans, La., Dec. 28 to Jan. 2. On the program of Section M (Engineering) are papers on "Laboratory Solution of River Problems," by Lieut. H. D. Vogel, U. S. Engineers, U. S. Waterways Experiment Station, Vicksburg, Miss.; "Rainfall in New Orleans and Its Removal," by George G. Earl, Sewerage and Water Board of New Orleans; "Foundations in New Orleans," by J. F. Coleman, New Orleans; "Inland Waterways," by Major R. F. Fowler, U. S. District Engineer, New Orleans; "Some Problems Appearing in Pipe-Line Transportation," by J. H. Pond, Rice Institute, Houston, Tex. Trips are planned to the Bonnet Carré spillway and other points of interest.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS will hold its 27th annual meeting in Cleveland Jan. 26-30. This will be a joint meeting with the American Society of Heating and Ventilating Engineers, and the Second International Exposition will be under way at the same time. Papers will be read covering air conditioning, refrigeration and public health, machinery for industrial applications and problems of the commercial-domestic refrigeration field.

NEW YORK STATE INSTITUTE OF INSURED SURVEYORS has been incorporated with the dual object of protecting the public from the incompetent surveyor and the surveying profession from a lowering of standards. Surveys made by members will be covered by insurance indemnifying the property owner for any loss due to legal action resulting from actual or alleged errors in the survey. The institute was formed in Bronx County, New York City; chapters are being organized in other counties throughout the state. Officers include: Charles F. Giraud, president; Howard W. Danfield, vice-president; Robert J. Eager, secretary. Headquarters are at 217 West 125th St., New York City.

Obituary

JOHN G. BUSCH, a member of the firm of Busch & Busch, Inc., road builders and excavators, of Kenmore, N. Y., died on Nov. 26. Mr. Busch was 69 years old and was active in contracting work until his death.

O. LENEVE FOSTER, assistant city engineer in Denver, Colo., was killed on Nov. 24 when the automobile he was driving collided with a tree. Mr. Foster was associated for a number of years with A. K. Vickery, city engineer, in the firm of Vickery & Foster, consulting engineers.

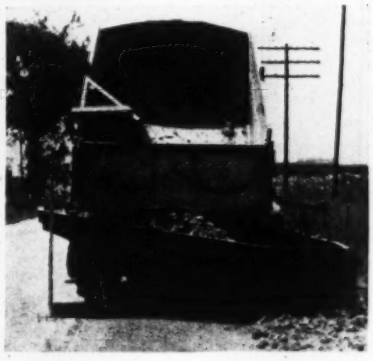
WILLIAM TUDOR GRISWOLD died on Dec. 2 at his home in North East, Pa., at the age of 72. Mr. Griswold, who was born in Brooklyn, N. Y., was graduated from Columbia University School of Mines in 1881 and went to Mexico to superintend the construction of the Sinaloa & Durango R.R. For 23 years he was in the United States Geological Survey.

Construction Equipment and Materials

Improved Road Equipment

Revisions in design affecting a number of pieces of road equipment have been announced by the Galion Iron Works & Mfg. Co., Galion, Ohio. Spreaders for stone, asphalt, slag and similar materials, for attachment behind a dump truck, are now available in 8- and 9-ft. widths in two types, one for covering the full width of the road, the other especially designed for road-widening work, discharging on the shoulder only. Construction features include self-locking strike-off adjustment, wide double angle runners to insure easy movement over hard or soft surfaces, and proper hopper slopes to insure a uniform flow of fine or wet material.

A new four-wheel traction drive now available for the company's motor-graders provides positive traction under all working conditions. On each side the axle is centered between two driving wheels connected through a set of gears. Both wheels are free to oscillate about the axle, so that they make contact under any conditions of travel and all do their full duty in promoting traction. The driving gears are fully inclosed and operate in a bath of oil, while the entire assembly is mounted on roller bearings to reduce power losses.



Spreader for road-widening work

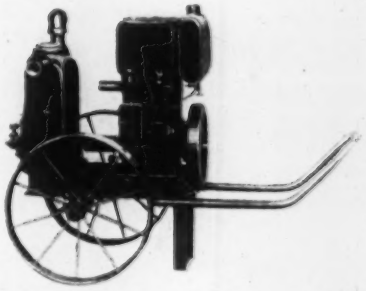
A V-shaped snow plow, made of heavy steel plate and thoroughly braced, is available for mounting on motor graders and maintainers. This plow is combined with and operated by the scarifier mechanism. The weight of the scarifier block is so balanced against the weight of the plow that raising and lowering is easy. This unit will readily open a 6-ft. path through deep snow and drifts.

Machine Fits Pipe for Welding

Quick and accurate preparation of pipe from 2 to 18 in. in diameter for fabrication into welded tees, miter elbows and bull plugs is the function of the Douglass pipe-fitting machine, distributed by H. A. Brassert & Co., 310 South Michigan Ave., Chicago, Ill. This machine will also bevel plain end pipe for butt welds. No templets or patterns are needed, as the required outline of the cut is generated in the machine itself and controlled by two simple adjustments. Power is provided by a standard electric motor with speed change box, which, throughout the generating mechanism, controls the movement of the cutting torch.

Self-Priming Centrifugal Pump Mounted on Truck

A new 2-in. self-priming centrifugal utility pump has been added to the line produced by the Novo Engine Co., Lansing, Mich. Priming is accomplished by having the ports and passageways arranged in such a way that the priming water cannot be thrown out of the discharge, but will circulate until it has expelled the air from the suction pipe. The steel impeller is of the open type, making it possible for the pump to handle a large proportion of solids without damage. The arrangement of the passages is such that there are no pockets to catch sand, gravel or other solids. The self-cleaning feature is effected by causing the main stream of water to pass down and through the bottom of the casing after the water has passed through the impeller. Any solids that might drop to the bottom of the pump are in this way swept out into the discharge.



Truck-mounted utility pump

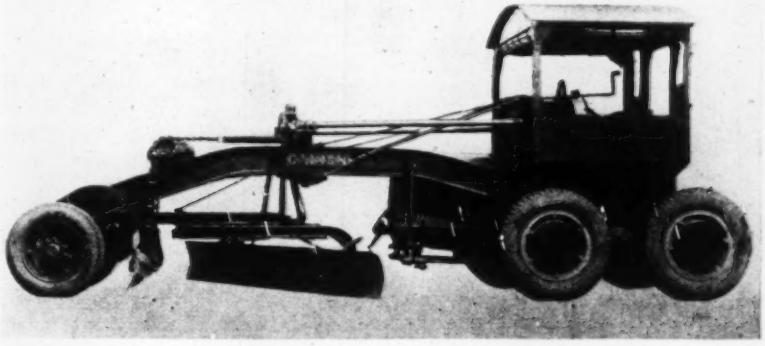
The two-wheel truck on which the pump is mounted makes it easy to transport, for there is less than 50 lb. weight on the handle. The pump weighs approximately 500 lb. and has a capacity varying from 220 g.p.m. against a 20-ft. head to 110 g.p.m. against 50 ft.

Small Electric Hammer

Operating through a flexible shaft connected with any light-type ½-in. electric drill, a new electric hammer weighing only 9 lb. is being offered by the United States Electrical Tool Co., 2490 West Sixth St., Cincinnati, Ohio. This unit will strike 400 blows per minute. Swedish steel is used in the hammer member, and high-grade ball and roller bearings throughout.

Manufactured Building Stone

Radical changes in manufacturing processes used to produce Vibrastone, a new product of the Benedict Stone Products Co., Chicago, Ill., has caused this organization to build a new plant utilizing special equipment and scientific methods. Vibrastone consists of cement and cracked stone, the latter being crushed to the exact size and shape required, that can be cast in any desired shape. The use of high-frequency electrical vibration and curing in specially designed kilns add to the quality of the product. Vibrastone resembles granite, marble or other quarry stones and is available in a wide range of colors, many of which cannot be obtained in quarry stone. Lightweight aggregates can be used, and the material will serve as fireproofing in a manner similar to concrete. A compressive strength in excess of 10,000 lb. per sq.in. at 28 days is claimed, and the material will absorb less than 3 per cent of its weight of water when immersed.



Rear control motor grader equipped with four-wheel drive

Current Construction Unit Prices

Bridge at Two Rivers, Wis.

THE 22d St. bridge over the Michicot River at Two Rivers, Wis., consists of one double-leaf bascule span 85 ft. c. to c. and six deck plate girder spans 61 to 73 ft. Total floor length is 503 ft. 1 in., clear roadway 36 ft., with two 6-ft. sidewalks. Piers are solid concrete, the abutment reinforced concrete, and all are on timber piles. The structure inludes a double-leaf deck cantilever rolling bascule span, allowing 70 ft. in the clear.

Ten bids were received Aug. 27, 1931, by the state highway commission, and unit prices are given of the lowest two: (A) Worden-Allen Co., Port Washington Rd., Milwaukee, $134,046, contract; (B) Wausau Iron Works, Wausau, $133,779. The third bid was $134,696. The state specifies a minimum wage of 40c. per hour.

	A		B
2,355 cu.yd. wet excav.	5.00	11,775.00	6.00
2,734.2 cu.yd. concrete for over 20-ft. span	12.30	33,630.66	15.00
25 M. ft. b.m. treated timber	100.00	2,500.00	90.00
1,008,010 lb. struct. steel	.0476	47,981.27	.047
18,200 lb. cast steel	.1083	1,971.06	.11
125,490 lb. reinf. steel	.034	6,524.00	.03
16,600 sq.ft. waterproofing	.02	332.00	.03
16,310 ft. untreated piles delivered	.40	6,524.00	.33
16,310 ft. above driven	.10	1,631.00	.15
4 manholes	21.00	84.00	10.00
36 fixtures for floor drains	8.00	288.00	8.00
100 cu.yd. concrete for counterweight	15.00	1,500.00	18.00
4,300 lb. track and rack castings	.20	860.00	.14
Machinery, complete	6,350.00	6,350.00	4,800.00
1,069 ft. ornamental rail	5.00	5,345.00	4.50
390 sq.yd. asphalt plank	2.00	780.00	2.00
103 lin.ft. treated timber fenders	1.00	103.00	3.00
930 ft. pipe rail	1.10	1,022.64	1.15
16 lamp standards, placing only	2.00	32.00	10.00
236 sq.ft. sheet lead	1.00	236.00	.90
		$127,295.69	
130 work days @ $50		6,750.00	
Contract total		$134,045.69	

Approach to West End-North Side Bridge Allegheny County, Pa.

EXTENSIVE approach work at the south end of West End-North Side bridge No. 3 over the Ohio River was placed under contract Sept. 1, 1931, by Allegheny County, Pa. The work consists of widening Carson St. from Musk Way to a point 750 ft. west of Steuben St. and constructing the approaches in this area, building a culvert to carry Saw Mill Run beneath the approach roads and railroads, constructing foundations of new Pittsburgh & West Virginia Ry. bridge, raising grades of South Main and Steuben Sts., raising the grade of a new street connecting South Main and Steuben Sts., and paving the entire area of this contract. Under separate contracts, the Pennsylvania R.R. will reconstruct the underpasses and replace the masonry arch structures at South Main St. and Steuben St. by steel plate girder spans. Layout of the south approach is shown in the drawing.

Unit price of the 3,200 lin.ft. of circular foundations for columns is per foot of depth. Minimum bearing is 28.27 sq.ft. on solid rock, though the shaft may have a diameter of 4 ft. at a distance of 3 ft. above the bottom of the foundation. Price covers excavation, forms, sheetpiling left in place, and the reinforced concrete.

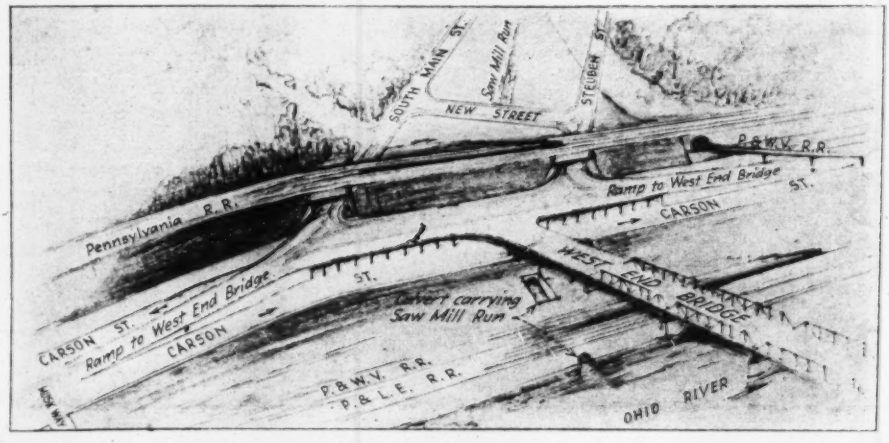
Nine bids were received averaging $825,000, and unit prices are given of the lowest two: (A) R. H. Cunningham & Sons Co., $731,588, contract; (B) F. W. Scott Co., $749,143. C. K. Harvey is principal assistant engineer, Allegheny County department of public works.

	A	B
1,500 cu.yd. excav. for found. below El. 703	$2.00	$2.50
17,800 cu.yd. excav. above El. 703	1.25	1.40
12,000 cu.yd. grading	.50	.70
4,300 cu.yd. concrete in found.	8.80	6.50
16,800 lin.ft. premolded concrete piles	1.47	1.85
2,760 lin.ft. pipe caissons	5.50	3.60
3,200 lin.ft. circular found. for columns	15.55	14.00
1,523 cu.yd. con. arch abuts.	10.80	7.05
Concrete:		
730 cu.yd., above found. in culvert wing walls	12.00	7.00
1,250 cu.yd. underpinning Penn. R.R. ret. walls	8.90	7.50
5,160 cu.yd. all abuts. and walls not above	10.00	6.65
3,612 cu.yd. class B above found. in reinf.-conc.	15.90	15.50
Superstructures, incl. columns:		
1,100 sq.ft. T Tri-Lok or equal floor for footbridges	.50	.81
61,600 lb. struct. steel, pins, anchor bolts	.06	.15
12,500 lb. malleable iron or cast steel in place	.15	.12
1,200 lb. chrome nickel iron or K-Monel metal in place	.80	.90
560 lin.ft. metal safety treads on concrete stairs	1.00	.80
1,800,000 lb. reinf. and dowels	.035	.03
7,080 sq.yd. membrane waterproofing	1.25	.95
6,100 sq.yd. asphalt plank protection for waterproofing	1.25	.80
5,500 sq.yd. tar waterproofing	.30	.25
54,000 cu.yd. granulated slag embank.	.65	.70
6,500 earth embank.	.50	.35
10,000 lin.ft. 7 x 24-in. granite curb	2.40	2.60
4,070 lin.ft. 5 x 16-in. granite curb	2.00	1.85
6,560 cu.ft. conc. base course	6.00	7.00
28,300 sq.yd. blockstone surface	3.00	3.45
6,500 lin.ft. 2½-in. steel elec. conduits in place	.65	1.00
1,300 lin.ft. 3-in. steel elec. conduits in place	.80	1.10
500,000 lb. steel sheetpiling left in place	.01	.03
2,500 bbl. cement	1.50	.160

Levee Construction in Arkansas

A LEVEE in drainage district 7, Poinsett County, Ark., let in September, 1931, for $295,880, involves 2,933,000 cu.yd. earthwork. The principal item is 1,550,000 cu.yd. at 11.4c. The contractor is Vollmer & Sons, Inc., Blytheville, Ark., and unit prices are given below.

Cubic Yards	Unit Price	Amount
1,550,000 levee embankment	$0.114	$176,700
25,000 spoilbank enlargement	.09	2,250
31,000 drains in flooding ditches	.22	6,820
12,000 muck ditch	.08	960
200,000 highway embankment	.12	24,000
485,000 channel excavation	.07	33,950
570,000 fill removal	.06	34,200
10,000 breaching fills	.20	2,000
15,000 spur dikes	.30	15,000



South approach to West End-North Side bridge for Allegheny County, Pa.

CONSTRUCTION NEWS

CONTENTS

	Page
Engineering Structures:	
Airports	212
Bond elections	211
Bridges	209
Dams	212
Equipment	213
Excavation	211
Federal Government	211
Foreign	214
Grade Crossings	212
Heating and Ventilating	212
Materials	213
Parks and Sports	212
Piers and Wharves	212
Power and Lighting	212
Railways	211
Sewers	209
Streets and Roads	209
Subways and Tunnels	211
Waste Disposal	209
Waterworks	209
Unclassified	212
Industrial Buildings:	
Factories and Mills	216
Garages	216
Power Plants	216
Shops and Foundries	216
Warehouses	216
Commercial Buildings:	
Banks	215
Churches	214
Clubs	214
Hospitals	214
Lofts	215
Offices	215,
Public	215
Residential	214
Schools	214
Stores	215
Theaters	215
Unclassified	215
Projects Delayed and Why	213

Some of the Week's Large Projects

For further details turn to the appropriate sections in this issue

Location	Project	Cost	Status
Railroads			
Pennsylvania	Railway electrification	$1,500,000	Proposed
Subways and Tunnels			
New York and Brooklyn	Subways	143,100,000	Proposed
Unclassified			
Oklahoma and Illinois	Pipe line	6,500,000	Proposed
Factories and Mills			
Tahoka (Tex.)	Chemical plant	1,500,000	Proposed
Power Plants			
Augusta (Ga.)	Power plant	2,500,000	Proposed
Buildings			
Baltimore	Apartment	1,500,000	Contract
Montclair (N. J.)	Cathedral	1,000,000	Proposed
New York	Hospital	1,400,000	Proposed
New York	Office	2,500,000	Contract
Washington	French Embassy	1,000,000	Proposed
Boston	Memorial building	1,000,000	Proposed
St. Paul (Minn.)	State office	1,000,000	Contract
Montreal (Que.)	Provincial office	1,000,000	Proposed

WATERWORKS

PROPOSED WORK

Ia., New Sharon — Waterworks additions, $15,000 bonds voted. T. H. Eckloff, town clk Noted Nov. 12.

Mass., Waltham—Bids latter part month Dale St. standpipe, and 9,000 ft. 12 in. pipe, $60,000.

Mo., St. Louis—City Water Dpt. bids early in 1932, five 150 x 150 ft. rein.-con. presedimentation basins and one 330 x 406 ft. sedimentation basin at Howard Bend Water Works Sta. on Missouri River, near Hine, $500,000, also altering boiler plant, incl. underpinning and excavating for new concrete basement, roof trusses, cement tile roof, structural steel, and boilers, at Chain of Rocks Water Works Plant on Mississippi River. $400,000. J. B. Dean, 1640 South Kinghighway, div. engr. Noted Nov. 5.

N. J., Jersey City—Bd. City Comrs., preliminary plans storage reservoir at Split Rock Pond for use as reservoir for Jersey City's drinking water, at Hibernia, $15,000 or more. J. Henderson, city engr.

Que., Bagotville—Town Council soon takes bids waterworks addition. $22,000.

Que., Dorval—Town Council, soon takes bids filtration plant addition, equipment, $60,000.

BIDS ASKED

Mass., Boston—Dec. 31, by Metropolitan Dist. Comn., 20 Somerset St., one 50 m.g.p.d. and one 14 m.g.p.d. steam turbine driven centrifugal pumping units, at Chestnut Hill Pumping Station 1.

Nev., Fallon—Town Bd., taking bids furnishing, laying 5,400 lin. ft. 12 in. c.i. pipe, deep well turbine, pump and motor, $15,000; reaming 24 in. well, 310 ft. deep, casing well with 16- to 20-in. casing, $20,200. J. R. Pennington, Carson City, engr.

Okla., Hobart—City Council bids about Dec. 20, water supply project, incl. earth dam with concrete spillway, 8.5 mi. 14 in. c.i. pipe or steel pipe line, 6,000 ft. 10 in. c.i. force main. W. R. Holway, 302 East 18th St., Tulsa, engr. Noted Oct. 29.

CONTRACTS AWARDED

Calif., Long Beach—City Council, 22 m.g. reservoir, consisting fabricating, erecting 6 steel tanks, 132 ft. diam., 35 ft. high, to Western Pipe & Steel Co., 5717 Santa Fe Ave., Los Angeles, $137,000. Noted Aug. 27.

Ill., Chicago—Dpt. P. Wks., two 60 m.g. steam turbine driven centrifugal pumping units for Mayfair Pumping Station, 4850 Wilson Ave., to De Laval Steam Turbine Co., 122 Michigan Ave., $163,970.

Ia., Vinton—Drilling 1,500 ft. well, to Thorpe Bros. Well Co., 2340 6th St., Des Moines, $9,132. Est. $13,00. Noted Nov. 12.

Mo., Princeton—Waterworks improvements, pump, to U. S. Wind Engine & Pump Co., 1100 Hickory St., Kansas City, $1,596; general contract, to Carrothers & Crouch, 4135 Kenwood Ave., Kansas City, $20,920; horizontal and vertical valves, to Kennedy Valve Mfg. Co., Elmira, N. Y., $10,751. Grand total $33,267. Noted Nov. 19.

N. Y., Long Island City—J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in Ankener St., to S. Gallucci & Sons, 33 Railroad Ave., Corona, $6,381; in Amory Ave., to Gregory Contg. Co., 351 East 124th St., New York, $8,668. Noted Nov. 19.

N. Y., Long Island City—J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, iron removal filter plant, Fresh Meadow Lane and Underhill Ave., to F. J. LeVoce & A. Izzo, 800 East 179th St., New York, $26,490; heating, to Murphy & Beaumont, 303 West 42nd St., New York, $2,500. Noted Nov. 12.

O., Hamilton—City, R. P. Price, mgr., 1¼ mi. 12 in. main south of Hanover St. and west of Baltimore & Ohio R.R. tracks, own forces, $36,000. Soon takes bids for materials. C. N. Telfer, dir. P. Wks.

O., Youngstown—City, Sect. B. for discharge piping on pumping station, Mahoning Valley Sanitary Dist. water project at Meander Dam, to Hetrick Co., Columbus $83,612 est. $100,000; Sect. A, discharge piping on pumping station, to United States Pipe & Fdry. Co., Burlington, N. J., $27,668; venturi meters, to Simplex Valve & Meter Co., 48th and Upland Sts., Phila., Pa., $13,195; furnishing, installing pneumatic equipment and handling chemicals, to Dust Recovering & Conveying Co. of 4063 East 116th St., Cleveland, $15,500. Grand total $139,975.

Tex., Rusk—State Bd. Control, c/o C. Teer, chn., Austin, 700 ft. dam, maximum height 49 ft., with protective appurtenant structures, ¼ mi. northeast of state hospital here, on Plan 3, using no sheet piling, to Dallas Transportation Co., 817 Bourbon St., Dallas, $23,837. Noted Nov. 19.

Ont., Caledonia—J. Avery, village clk., installing mains and constructing filtration plant, to G. B. Moogk, Weston, $23,877 and $20,333 respectively; elevated steel tank, to Horton Steel Wks., Bridgeburg, $9,530; electric pumps, motors, to Smart-Turner Machine Co., 191 Barton St. E., Hamilton, $2,240; hydrants, to Kerr Engine Co., Walkerville, $2,537. Grand total $58,517. Noted Nov. 20.

Ont., Oshawa—Public Utilities Comn., 110,000 gal. steel tank, to Horton Steel Wks. Ltd., Bridgeburg, $8,200. Noted Nov. 12.

SEWERS

PROPOSED WORK

Ill., Chicago—Bd. Local Impvts., City Hall rejected bids Sept. 15, 116th Place System of Sewers, incl. 6.5 mi. brick, tile sewers, concrete outfall sewers serving Mt. Greenwood and other adjacent communities, $1,000,000. Will readvertise. A. J. Schafmayer, City Hall, engr.

Ill., Collinsville—Bids early in 1932, sewage pumping station, disposal plant, system of 8- to 21-in. sanitary sewers in Sewer Dist. B, $265,000. L. B. Kinsey, Marshall Bank Bldg., Pekin, engr.

Mich., Lansing—No sketches have been prepared for brick, stone trim sewage pumping station, with motors, pumping equipment and 12,000 ft. sewage pressure main to plant, $100,000. **Maturity about summer 1932.** S. C. Jacka, City Offices, North Capitol Ave., engr. Noted Nov. 26.

Minn., Red Wing—City Council, storm sewers in Busch St. $30,000. S. T. Irvine, city clk.

Mo., St. Louis—Preliminary plans trunk line sewers in DeRaliviere Ave., to connect with River Des Peres Project near Jefferson Memorial, $74,000; Rosedale Ave., to connect with River Des Peres Project near western city limits, $55,000; South Harlem Creek extension in northwestern section city, $23,000; and Manchester Ave. to connect with River Des Peres Project near Sublette Ave., $45,000. W. W. Horner, city engr.

N. J., Westfield—Mayor and City Council, storm sewer from rear of high school to Lawrence, Kimball, Dudley and Mountain Aves., $50,000. Union Co. to share cost. Engineer not appointed.

Que., Chicoutimi—Sewers, $420,000. Part of work will be done by day labor, but bids will be taken for major portion.

Que., Jonquiers—City Council plans sewers, $62,000. Work will probably be done by day labor.

Que., Laprarie—Town Council soon takes bids sewers. $30,000.

Que., Port Alfred—Town sewers. $25,313.

BIDS ASKED

Calif., Signal Hill—Dec. 21, by City Council, Imhoff tank type disposal and treatment plant with trickling filter and sludge bed, about 3,000 sq.ft. tank, 26 ft. diam., 3 pumping stations, $70,000. Currie Eng. Co., Anderson Bldg., San Bernardino, engrs. Noted Nov. 19.

La., New Orleans—See "Streets and Roads."

Minn., St. Paul—Dec. 15, by C. A. Carlson, city purch., agt., constructing Kittsendale Sewer, Western Branch, Contr. C. W. N. Carey, city engr.

N. Y., St. George—Dec. 16, by J. A. Lynch, pres. Richmond Boro, Boro Hall, temporary sanitary sewer Elbe and McKee Aves.

Pa., Lancaster—Dec. 15, by T. W. Metzger, mayor, City Hall, relief, replacement and intercepting sewers, sewage pumping station, J. N. Chester Engineers, Clark Bldg., Pittsburgh, engrs.

Pa., Swissvale—See "Materials."

Ont., Barrie—See "Contracts Awarded."

Ont., Hamilton—See "Contracts Awarded."

CONTRACTS AWARDED

Ill., Galesburg—Bd. Trustees Galesburg Sanitary Dist., Contr. D, completing Cedar Fork Impvt., incl. interceptor, dredging Cedar Fork, bridges, paving, to Alexander-Repass Bros., Des Moines, Ia., $144,900. Noted Nov. 12.

Minn., Eveleth—City, sewage disposal plant, sewage pumping station and pressure line, to P. Maturi & Son, Chisholm, $32,954.

Neb., Morrill — Sanitary sewers, to J. Schwartz, Colorado Springs, Colo., $22,359.

N. H., Durham—University of New Hampshire, sewage disposal plant, to Ames Constr. Co., Somersworth. Est. exceeds $25,000.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., sewers in 88th Dr., to V. Galdo, 1022 63rd St., Brooklyn, $3,122; 91st Ave., to A. Cappso, 4121 Gunther Ave., New York, $3,012; Carpenter Ave., to H. R. Pinepuks, 131-37 133rd Ave., South Ozone Park, $836. Grand total $6,970. Noted Nov. 5.

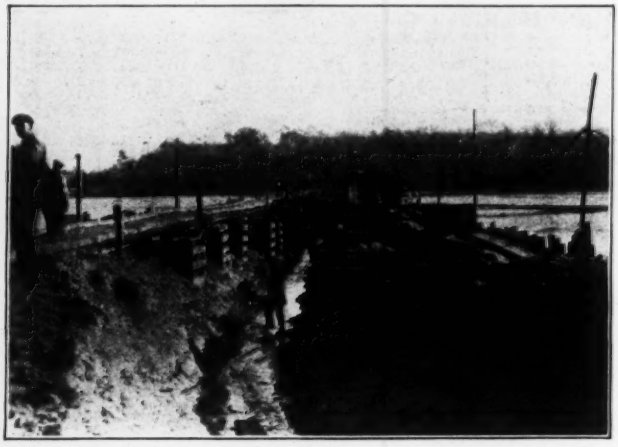
See proposal advertising on page 59

Constr. News page 209

LEADITE

Trade Mark Registered U.S. Pat. Office

30" c.i. bell and spigot Water Main —across the Wisconsin River



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Under and over rivers, suspended from bridges, over mountains, across rough and rocky country, around sharp curves, under well-paved streets, across marshes, through beautiful parks and estates, under railroad tracks, etc., etc.

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Tested and used for over 30 years.
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Sewers (Continued)

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., to P. J. Greenough, 9919 Guilford Ave., Forest Hills, sewers in 23rd Ave. $706, Forest Aves. $1,069, 63rd St., $1,462, 40th Dr. $2,336; to L. Piali, 71 Ridge St., Astoria, 35th Ave. $2,127, to Catam Co., 8211 Bay Parkway, Brooklyn, Harrow St. $1,473, 193rd St. $1,447; to Logran Contg. Co., 2301 Beverly Rd., Brooklyn, Penelope St. $44,306; to Matarazzo & Yondola, 1163 61st St., Brooklyn, 168th St. $4,418, 107th Ave. $5,838; to L. Collins & Sons, 147th St., Whitehall, 210th St. $1,212; to Nepolitano Constr. Co., 92-18 Liberty Ave., Woodhaven, Sanford Ave. $6,892; to A. Maio, 123-07 116th Ave., 135th St. $1,127; to P. Ambrosio, 674 Glenmore Ave., Brooklyn, 189th St. $3,173; to Franciose & Giammarco, 34 Mulberry St., New York, 195th St. $1,262; to A. Capasso, 4121 Gunther Ave., New York, Hollis Ave. $2,890; to J. Clemente, 130-05 116th Ave., South Ozone Park, Inwood Ave. $12,169; to Belfatto Constr. Co., Foch Blvd., South Ozone Park, Woodhull Ave., $1,986. Grand total $95,894. Noted Nov. 26.

N. Y., Newark — Municipal Bldg., Village Hall, sewage disposal plant, to Scott Bros. Constr. Co., 31 Exchange St., Rochester, $101,000-$110,000. Noted Nov. 19.

N. Y., New York—H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., sewers in Morgan and Pitman Aves., to Naclerio Constr. Co., 2562 Wallace Ave., $3,813 and $8,286 respectively. Noted Nov. 19.

Pa., Munhall—City, L. Y. Woodward, secy., Municipal Bldg., 11 mi. terra cotta and reinforced con. sanitary sewers to McCrady Constr. Co., Investment Bldg., Pittsburgh. Est. $200,000. Noted May 21.

Pa., Paxtang—Boro Council, A. M. Bell, secy., sanitary sewerage system, incl. 5.5 mi. sewers, to J. McCormick, Erie, $64,998. Noted Oct. 29.

Wis., Milwaukee — Metropolitan Sewerage Comn., main sanitary sewers in River Rd., Lincoln Park, Belle Isle and Riverview Drs., to Anderson & Co., 56 East 89th St. Pl., Chicago, Ill., $126,833; in Hampton Ave. and Lincoln Creek Parkway, to Zimmerman & Zimmerman, 315 Alta Vista Ave., Wauwautosa, $47,683.

Ont., Barrie—Town Council, storm sewers, paving, day labor. $25,000. Noted Oct. 15.

Ont., Hamilton—Council, sewer extension, Wellington St. $50,000, Gage Ave. $25,000, day labor, under supervision of W. L. McFaul, city engr.

Que., Montreal—Executive Com., sewers in Gouin Blvd. to Kelly St., to G. Mills, 2 York St. $104,352.

WASTE DISPOSAL

PROPOSED WORK

Pa., Johnstown—City, M. Z. Smith, dir. Pub. Safety, City Hall, soon takes new bids incinerating plant, incl. stack 125 ft. high, scale house, 50 ton furnace, or renovating present plant, with new floors, furnaces, Elk Run Rd., Lower Yoder Twp. $70,000. H. L. Wilson, City Hall, engr.

BRIDGES

PROPOSED WORK

Mass., Nantucket—Town, Bd. Selectmen, rebuilding Massasoit Bridge. $25,000 or more.

New Hampshire—State Hy. Comn., Concord, F. E. Everett, engr., surveys rein.-con. overpass bridge, Winnisquam Sect., Belmont Co. $100,000.

O., Cleveland—City bids after Jan. 1, four 80 ft. span steel, rein.-con. bridge at West 143rd St. and Lorain Ave. $500,000. City will pay cost of approaches, incl. grading, sewer lines, paving, retaining walls, New York Central R.R. Co., 46 Lexington Ave., New York, F. W. Freeman, ch. engr., will pay cost of bridge proper. G. W. Heffelfinger, City Hall, engr.

Wash., Seattle—Bd. P. Wks., replacing present structure with rein.-con. bridge over Schmitz Park Canyon. $85,000.

Que., St. Joseph d'Alma—Village Council obtained Provincial Govt. approval to construct bridge, fire station. $70,000.

BIDS ASKED

California—Dec. 16, by State Hy. Comn., Sacramento, five 40 ft. span rein.-con. bridge on concrete bents over Canyon Creek, 11 mi. west of Weaverville, Trinity Co.; 2 rein.-con. bridges, one 320 ft. open spandrel arch and 6 girder approach spans, varying in length from 51½ to 394 ft. over Big Dann Creek, 7.5 mi. south of Lanes Flat, other 320 ft. open spandrel arch span with 6 girder approach spans varying in length from 46½ to 494 ft. across Cedar Creek, both Mendocino Co. C. H. Purcell, hy. engr.

Calif., San Francisco—Dec. 16 and 23, by C. H. Purcell, ch. engr., San Francisco-Oakland Bay Bridge, 500 Sansome St., investigation of bridge foundation sites at San Francisco approach, boring cased holes and diamond drilling through bedrock, taking samples material encountered for investigation, 4,000 lin.ft. and 100 lin.ft. cased holes from ground line to bedrock, 250 lin.ft. and 2,400 lin.ft. diamond drilling through bedrock. Noted Oct. 29.

Indiana—Dec. 22, by State Hy. Comn., Indianapolis, 52½ ft. bridge on Rd. 1 south of Auburn, DeKalb Co.—96 ft. bridge 3 mi. west of Kingman—two 75 ft. span bridge 5.7 mi. east of Kingman, both Rd. 234, Fountain Co.—72 ft. bridge, Rd. 16, 4.6 mi. east of Foresman, Jasper Co.—one 40 ft. and three 175 ft. span bridge over east fork of White River at Shoals, Martin Co.—150 ft. bridge 1.7 mi. east of Brook—36 ft. bridge near Foresman, both Rd. 16 Newton Co.—two 60 ft. span bridge 7.1 mi. south of Salem—two 55 ft. span bridge 4.9 mi. south of Salem, both Rd. 35, Washington Co.—two 35 ft. span bridge 2.7 mi. north of Boston, Rd. 21, Wayne Co.—re-erecting 66 ft. steel truss superstructure 5 mi. south of Reynolds, Rd. 43, White Co. J. J. Brown, dir.

Me., Carmel—Dec. 14, by State and Maine Central R.R., A. H. Morrill, ch. engr., 222 St. John St., Portland, rebuilding steel superstructure bridge. $40,000.

Maryland—Dec. 15, by State Roads Comn., Baltimore, triple span concrete girder bridge over Elk River, on Elkton-Chesapeake City Rd., Contr. Ce-112-27, Cecil Co.; substructure approaches for Hill's Bridge, Upper Marlboro-Mt. Zion Rd., Contr. AA-121-87, Anne Arundel Co. H. Williar, Jr., Federal Reserve Bank Bldg., Baltimore, engr.

Maryland—Dec. 15, by State Roads Comn., G. C. Uhl, chn., Baltimore, substructure approaches, etc. for proposed bridge over Patuxent River, Contr. AA-121-87, Anne Arundel Co.; triple span, concrete girder bridge, Contr. Ce-112-27, Cecil Co.; adv. E. N.-R. Dec. 10.

Michigan—Dec. 16, by A. L. Burridge, div. engr., Cadillac, FB1 of 35-2-11, Contr. 3, 2 rein.-con. abutments, counterfort type, 32 ft. 4 in. from botton of footings to crown of roadway, crossing Au Sable River, Losco Co., for State Hy. Comn., Lansing.

New Jersey—Dec. 21, at office State Hy. Dpt., Trenton, bridge over tracks of Hudson River Traction Co. and Pleasant Ave. on Route 2, Sect. 6, Rochelle Park and Paramus Boros, Bergen Co., A. L. Grover, ch. elk.; adv. E. N.-R. Dec. 10.

Ohio—Dec. 18, by O. W. Merrell, dir. hys., Columbus, bridges in Adams, Ashtabula, Clermont, Defiance, Erie, Fayette, Fulton, Gallia, Geauga, Greene, Guernsey, Hardin, Henry, Highland, Holmes, Huron, Jackson, Knox, Licking, Lorain, Lucas, Mahoning, Medina, Mercer, Morgan, Morrow, Muskingum, Ottawa, Paulding, Portage, Richland, Stark, Summit, Vinton and Warren Counties, some of the larger jobs are three 45 ft. span, concrete beam bridge, 24 ft. roadway, Sect. "A-2" Jefferson-Madison Rd., Ashtabula Co., $38,854—two 45 ft. span, concrete beam bridge, 30 ft. roadway, two 4.5 ft. sidewalks, Sect. "Mt. Gilead" Delaware-Mt. Gilead Rd., Morrow Co., $28,444—two 36 ft. span, concrete beam bridge, 44 ft. roadway approaches, Sect. "J" Cleveland-East Liverpool Rd., Summit Co., $35,146—42 ft. span, concrete beam bridge, 45.4 ft. roadway, two 6 ft. sidewalks, Sect. "Akron" Akron-Kent Rd., Summit Co., $24,935—36 ft. span, and one 19.5 ft. span and 14 ft. span, concrete slab bridges, all 24 ft. roadways, Sect. "C" Milford-Vera Cruz Rd., Clermont Co., $19,551—two 32 ft. span, concrete slab bridge, 29 ft. roadway, two 3 ft. sidewalks, Sect. "Jeffersonville" Springfield-Washington C.H. Rd., Fayette Co., $20,550—grade separation with concrete slab overpass, brick paving, Sect. "A" Toledo-Detroit Rd., Lucas Co., $78,515. Total est. $748,652.

Oklahoma—Dec. 15, by State Hy. Dpt., Oklahoma City, one 1 span 120 ft. steel truss bridge on concrete piers and one 7 span 118 ft. rein.-con. trestle bridge, both at Coalgate, Coal Co., $25,000 and $27,000 respectively; 14 span 310 ft., rein.-con. overpass over Missouri, Kansas & Texas Ry. near Welch, Craig Co. $35,000—7 span 112 ft. rein.-con. bridge at Stillwater, Payne Co., $25,000. C. L. Wilson, hy. engr.

Pa., Pittsburgh—Dec. 15, by R. G. Woodside, controller Allegheny Co., Court House, superstructure for Pittsburgh & West Virginia R.R. Section of West End-North Side Bridge over Ohio River, removing existing bridge and maintenance of traffic, incl. 900,000 lb. structural steel, 20,000 lb. steel reinforcing, 625 sq.yd. rein.-con. slabs, $66,500. V. R. Corell, County Office Bldg., engr.—repaving portion 2nd Ave. approach to Glenwood Bridge over Monongahela River, 250 cu.yd. concrete, 530 lin.ft. sandstone curb, 1,250 sq.yd. blockstone and 50 tons asphaltic surfacing, $10,000—removing Bridge 10, Montour Run, re-erecting Bridge 4, over Deer Creek with approach filling, removing Bridge 1, Montour Run and Bridge 4, over Deer Creek, $6,000. Noted Oct. 8.

Sask., Saskatoon—G. D. Archibald, city engr., taking bids 5 arch rein.-con. bridge, 1,100 ft. long, incl. approaches over Saskatchewan River, at 4th Ave. $850,000. Part of work will be done by day labor for unemployment relief. Owner interested in prices on cement and steel.

CONTRACTS AWARDED

Calif., Yreka—C. H. Purcell, engr., State Hy. Comn., Sacramento, three 40 ft. span concrete girder bridge on concrete bents, abutments with wing walls, 24 ft. roadway, 21 mi. north of here, Siskiyou Co., to J. W. Halterman, Willows, $16,372.

Maryland — State Roads Comn., Baltimore, G. C. Uhl, chn., substructure, superstructure (with exception structural steel span over Pennsylvania R.R. tracks), approaches, etc., for proposed grade elimination over relocated railroad tracks at North St., Elkton, Contr. Ce-76-23, Cecil Co., to Henry L. Maas & Son, 1119 Ensor St., Baltimore, $99,579. Noted Nov. 12.

Michigan—W. J. Kingscott, div. engr., 213 Watson Bldg., Grand Rapids. (a) FBr. 1 of 61-7-9, Contrs. 1 and 2, one 40 ft. span, 2 rein.-con. semi-gravity type abutments, steel deck girder, two 3½ ft. sidewalks, 40 ft. roadway. (b) MBr. 3 of 61-12-1, Contrs. 1 and 2, two 30 ft. and five 40 ft. spans, 2 rein.-con. skeleton type abutments, steel deck girder, one 24 ft. and one 5 ft. sidewalks, 22 ft. roadways, both Muskegon Co., for State Hy. Comn., Lansing, to McClintic-Marshall Corp., 1242 Book Bldg., Detroit, (a) Contr. 1 $9633, (b) Contr. 1 $4,338 to E. W. Krueger, Muskegon, (a) Contr. 2 $26,000 to Wickes Engineering & Constr. Co., 1441 Bluff St., Des Moines, Ia., (b) Contr. 2 $38,119. Grand total $89,450. Noted Nov. 5.

Michigan — W. J. Kingscott, div. engr., at office Kent County Road Comn., Grand Rapids, Bridge 1 of 41-8-20, Kent Co., for State Hy. Dpt., Lansing, Contr. 1, to Fort Pitt Bridge Wks., Massillon, O., $7,188, Contr. 2, to Peninsular Constr. Co., Grand Rapids, $23,451. Noted Nov. 5.

Michigan—H. W. Hazaman, div. engr., 504 Eddy Bldg., Saginaw, MBI of 77-21-5, Contrs. 2 and 3, 70 ft. span, 2 rein.-con. semi-gravity type abutments, steel deck girder 40 ft. roadway, two 6 ft. sidewalks over Belle River St. Clair Co., for State Hy. Comn., Lansing, Contr. 2, to Fort Pitt Bridge Wks., Massillon, O., $8,755, Contr. 3, to Coolsaet Bros. Corp., Dearborn, $10,811. Noted Nov. 12.

Michigan—J. T. Sharpensteen, div. engr., Escanaba, FB 1 of 2-1-14 Contrs. 2 and 3, three 50 ft. spans, 2 rein.-con., semi-gravity type abutments, steel deck girder, 30 ft. roadway, two 2½ ft. sidewalks over Au Train River, Alger Co., for State Hy. Dpt., Lansing, Contr. 2, to Fort Pitt Bridge Wks., Massillon, O., $4,223, Contr. 3, to G. A. Gustafson, Iron Mt., $26,282 incl. cement. Noted Nov. 12.

Michigan—J. T. Sharpensteen, Escanaba, MB 1 of 22-1-14 Contrs. 2 and 3, one 40 ft. span, 2 rein.-con., semi-gravity type abutments, steel deck girder, two 2½ ft. sidewalks over Sturgeon River, Dickinson Co., for State Hy. Comn., Lansing, Contr. 2, to Worden-Allen Co., Ft. Washington Rd., Milwaukee, Wis., $1,051; Contr. 3, to C. G. Bridges, Escanaba, $5,919.

Minn., Brainerd—State Hy. Dpt., St. Paul, Bridge 5060, 5 span 610 ft. concrete arch over Mississippi River, S.P. 2-30-4, to McKenzie-Hague Co., 422 Corn Exchange Bldg., Minneapolis, $183,555. Noted Oct. 22.

New Jersey—Bd. Freeholders Hudson Co., Court House, Jersey City, redecking Park Ave. Viaduct between Weehawken and Hoboken, to Stillman, Delanty-Ferris Co., 1 Exchange Pl., Jersey City. $25,000.

Ohio—O. W. Merrell, dir. hys., Columbus, 62 ft. span, steel I-beam bridge, Athens Co., to Ray Strawser, Inc., 852 North Cassady Ave., Columbus, $17,658—three 40 ft. span creosoted timber bridge, steel stringers, Coshocton and Licking Counties, to New Bremen Bridge & Constr. Co., New Bremen, $11,103—62 ft. span steel I-beam bridge, Fairfield Co., to C. R. Boulton, 10 East Town St., Columbus, $17,472—two 40 ft. span concrete beam bridge, Hancock Co., to W. S. Hostler, Mt. Blanchard, $11,560—three 40 ft. span concrete beam bridge, Seneca Co., to J. H. Jones & Son, 433 South Poplar St., Fostoria, $16,848—24 ft. span and 22 ft. span, concrete slab bridge and concrete box culvert, Hocking Co., to Shatto Constr. Co., 511 Market St., Spencer, W. Va., $15,275. Grand total $89,916. Noted Nov. 19.

STREETS AND ROADS

BIDS ASKED

California—Dec. 16, by State Hy. Comn., Sacramento, grading, asphaltic concrete paving 4.5 mi. hy. between point 4.5 mi. east of Loeh and point 1.8 mi. east of Clements, San Joaquin Co., to C. H. Purcell, hy. engr.

California—Dec. 23, by C. H. Purcell, engr., State Hy. Comn., Sacramento, grading 11.5 mi.

Iowa—See "Contracts Awarded."

La., New Orleans—Dec. 15, by City Council, concrete paving, various types wearing surfaces 3,125 ft. Venus St., $40,000—4,200 ft. Nashville Ave.—3,200 ft. Hennessy St., $35,000—2,000 ft. General Pershing Ave., $40,000—3,750 ft. Clouet St., $45,000—concrete or rein.-con. paving, various types of wearing surfaces 6,100 ft. St. Ann St., $80,000—2,400 ft. Josephine St., $35,000—installing sub-surface drainage, manholes, handholes, cleanouts; concrete sidewalks, concrete paving, various types of wearing surfaces 240 ft. Cadiz St.—650 ft. Cromwell Pl., $15,000—675 ft. Calhoun St., $15,000—625 ft. Gayoso St., $15,000—1,550 ft. Galvez St., $30,000—1,000 ft. D'Hemecourt St., $22,000—1,670 ft. Independence St., $35,000—740 ft. Lafitte St., $5,000—2,115 ft. Miro St., $42,000—2,125 ft. Prieur St., $45,000—2,125 ft. Roman St., $45,000—1,000 ft. Rendon St., $25,000—1,625 ft. Touro St., $35,000—240 ft. Toulouse St., $5,000—1,650 ft. Tonti St., $35,000—240 ft. Saratoga St., $5,000—700 ft. Upperline St., $18,000—sub-surface drainage system, manholes, handholes, cleanouts, catchbasins 6,100 ft. St. Anne St., $35,000—12,000 ft. concrete sidewalks on St. Anne St., $26,000—sub-surface drainage system, manholes, cleanouts, concrete sidewalks 4,200 ft. Nashville Ave., $30,000—2,400 ft. Josephine St., $25,000—3,200 ft. Hennessy St., $30,000—2,000 ft. General Pershing Ave., $25,000—3,125 ft. Venus St., $30,000—3,750 ft. Clouet St., $35,000.

Md., Baltimore — Dec. 16, by Bd. Awards, concrete paving 15,000 sq.yd. footways, listed in Repair Contr. 7. G. Cobb, Municipal Bldg., hys. engr.

Minnesota—Dec. 22, by State Hy. Dpt., St. Paul, grading, concrete paving 15.3 mi. S.P. 3-24, Sects. 1 and 2, 418 and S.P. 59-21, Sect. 4, Div. B—13.5 mi. S.P. 3-53, Sect. 2, F.A.P. 27C, and S.P. 3-53, Sect. 1, F.A.P. 27B—10.8 mi. S.P. 4-47, Div. A, F.A.P. 405A, and S.P. 8-25, Div. B, F.A.P. 57—19.3 mi. S.P. 5-38,

Constr. News page 209a

Streets and Roads (Continued)

Sect. 3, F.A.P. 422B, S.P. 5-38, Sect. 1, F.A.P. 422C, and S.P. 5-38, Sect. 2—11 mi. SP 6-47, FAP 388A—16.1 mi. S.P. 8-34, F.A.P. 302 and S.P. 8-52, Sect. 1, Div. A, Sect. 278—7.7 mi. S.P. 8-52, Sect. 1, Div. B, F.A.P. 278, and S.P. 8-52, Sect. 2, Div. A, F.A.P. 278—17.3 mi. S.P. 8-52, Sect. 2, Div. B, F.A.P. 278, S.P. 8-42, F.A.P. 302B, and S.P. 8-39A, F.A.P. 302B—15.6 mi. S.P. 15-33, Sect. 1, F.A.P. 72, and S.P. 15-33, Sect. 3, F.A.P. 196, S.P. 15-33, Sect. 2, Div. A, F.A.P. 417B—6.9 mi. S.P. 15-33, Sect. 2, Div. B—18.4 mi. S.P. 14-25, Sect. 2, Div. B, F.A.P. 425B and S.P. 14-25, Sect. 1, Divs. A and B, F.A.P. 425A—7.1 mi. S.P. 14-25, Sect. 1, Div. C, F.A.P. 425A—15.2 mi. S.P. 18-23, Sect. 3, F.A.P. 9 and S.P. 18-23, Sect. 1, Div. B, F.A.P. 3—6.4 mi. S.P. 18-23, Sect. 1, Div C, F.A.P 3—8.8 mi. S.P. 20-25, Div. B, F.A.P. 250—19.8 mi. S.P. 20-37, Sect. 1, F.A.P. 39, and S.P. 20-37, Sect. 2, F.A.P. 137—15.2 mi. S.P. 30-29, F.A.P. 50 and S.P. 30-27, F.A.P. 271.

Mississippi—Dec. 17, by State Hy. Comn., Jackson, grading, bridging, clearing, grubbing, concrete paving 1,073 sq. yd. Meridian-Hattiesburg Rd., Federal Aid Project 135-Reopened, Lauderdale Co., incl. 14,244 lb. reinforcing and 63,160 lb. structural steel. C. M. Williams, dir.

N. Y., Buffalo—Dec. 17, by W. A. Rathman, comr. P. Wks., Municipal Bldg., grading Harbor Turnpike—paving Wade Ave.—repaving Claremont Ave.

Ohio—Dec. 18, by O. W. Merrell, dir. hys., Columbus, grading, drainage structures 3.75 mi. Sect. "H-1" Atwater-Troy Rd., Portage Co., $39,750.

Oklahoma—Dec. 15, by State Hy. Dpt., Oklahoma City, grading, drainage structures 7.71 mi. State Hy. 48, south of Pontotoc Co. line, 32 ft., Johnston Co. $30,009; 10.6 mi. State Hy. 27 north of Heavener, 27 ft., LaFlore Co. $35,000. C. L. Wilson, hy. engr.

Pa., Pittsburgh—See "Bridges."

Pa., Swissvale—See "Materials."

Tex., Waco—Dec. 21, by McLennan Co., c/o R. B. Stanford, judge, graveling 28 mi. lateral roads as follows: West Rd. Route 1—Bruceville Rd. Route 2—McGregor Rd. Route 3—Axtell Rd. Route 1—Prim Lane and Bosque Blvd., 16 ft. Hannah, Waco, co. engr.

Washington—Dec. 22, by S. J. Humes, dir. Hys., Olympia, grading, crushed stone surfacing 3,450 cu.yd. State Rd. 21, Kitsap Lake North, Kitsap Co.; 28,850 cu.yd. Inland Empire Hy. Eastern Route, Idaho State Line to Colton, Whiteman Co.

Wash., Seattle—Dec. 21, by Comrs. King Co., concrete paving 0.5 mi. North 103rd St., Woodland Park to Greenwood Aves. T. D. Hunt, Seattle, engr.

CONTRACTS AWARDED

California—State Hy. Comn., Sacramento, grading, bituminous treated crushed gravel or stone surfacing 8.5 mi. hy. between Casa Diablo, Hot Springs and Crestview, Mono Co., to Morrison-Knudsen, Boise, Idaho. $142,170. Noted Nov. 12.

California—C. H. Purcell, engr. State Hy. Comn., Sacramento, widening, grading, concrete paving road between point 2 mi. north of Solomon Summit and point 1.5 mi. south of Santa Maria, Santa Barbara Co., to Frederickson & Watson Constr. Co., 354 Hobart St., Oakland, $188,811. Noted Nov. 19.

Delaware—State Hy. Dpt., Dover, clearing, grubbing, grading, concrete paving 2.6 mi. Contr. 209, New Castle Co., to Edward Fay & Son, 244 North 55th St., Phila., Pa., $104,398—5.57 mi. Contr. 176, Sussex Co., to Walter Roach & Sons, Georgetown, $84,405—clearing, grading, grubbing, traffic bound crushed slag surface course 3.83 mi. Contr. 194, and clearing, grubbing, graveling 4.1 mi. Contr. 177, both Sussex Co., to Old Line Constr. Co., Chestertown, $25,284 and $16,711, respectively—grading, terra cotta sewer, catch basin, drop inlet castings, concrete sidewalks, 6,500 ft. Contr. 210, New Castle Co., to E. Di Sabatino & Sons, 839 Tatnall St., Wilmington, $10,680—2,720 ft. Contr. 211, Kent Co., to Gooden & Clark, Dover, $2,826—4,300 ft. Contr. 212, Kent Co., to Smyrna Cement Products Co., Smyrna, $5,568—1,600 ft. Millsboro Rd. towards Harmon School Contr. 214, to J. E. Friedel & Co., Bridgeville, $1,509—3,000 ft. fill, Barkers Landing Causeway, Contr. 215, New Castle Co., to J. Ciccone, Phila., Pa., $47,240. Grand total $208,621. Rejected bids grading, catch basin and drop inlet castings, terra cotta pipe, concrete sidewalks, 1,025 ft. Blades-Seaford Town Lines, Contr. 213, Sussex Co. Noted Oct. 22.

Ill., Galesburg—See "Sewers."

Ill., Greenville—Bond Co., gravel or stone surfacing 1.6249 mi. State Aid Route 1, Sect. 2-A-15d, 16 ft. wide with 7 ft. shoulders, to Louis Rich Constr. Co., 2038 St. Clair Ave., East St. Louis, $13,078; 4.3334 mi. State Aid Route 13, Sect. 5-M.F.T., 16 ft. wide with 7 ft. shoulders, to G. A. Hackett, Decatur, $7,968. Grand total $21,046. Noted Oct. 1.

Ill., Harrisburg—Saline Co., traffic bound gravel surfacing 1.482 mi. State Aid Route 14, Sect. 12G-M.F.T., 18 ft., to Barter & Kilman, Harrisburg, $7,797—1.306 mi. State Aid Route 16, Sect. 13G-M.F.T., 16 ft., to Bishop & Spurlock, Eldorado, $10,616—2.651 mi. State Aid Route 6, Sect. 3G-M.F.T., 14 ft., to Charles Groff, Grayville, $6,328—concrete surfacing 0.823 mi. State Aid Route 10, Sect. 14-M.F.T. 8 and 16 ft., 6 ft. earth shoulders, to Kerr & Murphy, Bloomington, Ind., $13,771. Grand total $38,512.

Constr. News page 210

Iowa—State Hy. Comn., Ames, crushed rock surfacing 12 mi. Hy. 4 from Oakland to Mills Co. Line, own forces. R. F. White, hy. engr.

Kansas—State Hy. Comn., Topeka, to Yant Constr. Co., Omaha Natl. Bank Bldg. Omaha, Neb., sand gravel or chats surfacing 9 mi. Project 7501 $2,556; 7 mi. Project 7502 $1,988; 12 mi. Project 7503 $4,968; 12 mi. Project 7504 $4,968, all Scott Co.—to D. G. Hansen, Logan, 6 mi. Hodgeman Co. $1,656—to Cook & Cone, Ottawa, sand gravel or chats surfacing 1.534 mi. Project 1286 $943, 3.021 mi. Project 1267 $1,857, both Coffey Co., 19.5 mi. Finney Co. $4,446—to F. H. Freeto, Pittsburg, chats surfacing 10 mi. Project 7496 $4,120, 10 mi. Project 7497 $3,910; 2 mi. Project 7499 $716, all Miami Co.—to Roberts Constr. Co., Orpheum Bldg., Wichita, light type surfacing 9.4 mi. Nemaha Co. $3,524—to Thogmartin & Reis, Ft. Scott, 7 mi. Douglas Co. $4,638; 7 mi. Project 7490 $3,633; 5 mi. Project 7491 $2,354, both Johnson Co., 13.75 mi. Marshall Co. $2,637. Grand total $48,914. Noted Nov. 5.

Kan., Topeka—City Council, widening, asphaltic concrete on concrete paving West 10th St. from Polk St. to Kansas Ave., to Kaw Paving Co., 616 New England Bldg., Topeka, $48,-685; sewers, to Thompson & Schooley, 2503 North 12th St., $19,701.

Louisiana—State Hy. Comn., Baton Rouge, gravel surfacing 5.451 mi. hy. in Jackson Parish, reawarded to Harvey & Jones, Jonesboro, $20,914—4.646 mi. Evangeline Parish, reawarded to Erickson & Gondeau, Opelousas, $15,393—2.1 mi. Bienville Parish, reawarded to W. H. Williams, Arcadia, $10,074. Grand total $46,381. Noted Nov. 19, under "Contracts Awarded."

Maryland—State Roads Comn., C. C. Uhl, chn., Baltimore, gravel surfacing 2.17 mi. Contr. P-167-32 Prince George's Co., to G. & L. Contg. Co., Maple Ave., Overlea, Baltimore, $30,240. Noted Sept. 24.

Michigan—A. L. Burridge, div. engr., Cadillac, grading, drainage structures 7.174 mi. MO5-2OC-1, Antrim Co., for State Hy. Comn., Lansing, to L. Garavaglia, 2223 Scott St., Detroit, $90,697 incl. cement. Noted Nov. 12.

Michigan—H. W. Hagaman, div. engr., 504 Eddy Bldg., Saginaw, grading, drainage structures 2.739 mi. MO73—C-3 Saginaw Co., for State Hy. Dpt., Lansing, to C. A. Handeyside Constr. Co., 12-233 General Motrs. Bldg., Detroit, $23,953; 8.2 mi. FO-25-22 C-2, Genesee and Shiawassee Co., to Goldberg Constr. Co., Durand, $39,145. Noted Nov. 12.

Michigan—W. J. Kingscott, div. engr., 213 Watson Bldg., Grand Rapids, partially grading road and concrete paving 3.181 mi. FO41-37C-3, Kent Co., for State Hy. Comn., Lansing, to John R. Edelman Co., Muskegon Heights, $87,-499. Noted Nov. 5.

Michigan—W. J. Kingscott, div. engr. 213 Watson Bldg., Grand Rapids, grading, drainage structures 5.512 mi. FO70-28C-1 and FO61-27C-2, Ottawa and Muskegon Counties, for State Hy. Dpt., Lansing, to Hilliding Constr. Co., Bay City, $29,121. Noted Nov. 12.

Michigan—H. G. Oakes, div. engr., Plymouth, grading, shaping, drainage, concrete paving 1.226 mi. MO13-21C-1 and MO12-2OC-1, Branch and Calhoun Counties and 0.998 mi. MO13-17CO1, Calhoun Co., for State Hy. Comn., Lansing, to Grace Constr. & Supply Co., Marshall, $25,617 and $25,561 (incl. cement) respectively. Noted Nov. 12.

Michigan—H. G. Oakes, div. engr., Plymouth, widening grade, lengthening drainage structures 7.956 mi. MO63-8C-4, Oakland Co., for State Hy. Dpt., Lansing, to C. A. Handeyside, Detroit, $33,184. Noted Nov. 5.

Michigan—H. G. Oakes, div. engr., Plymouth, widening grade, lengthening drainage structures 8.485 mi. MO47-15C-3, Livingston Co., for State Hy. Comn., Lansing, to J. A. Mercier Co., 450 West Fort St., Detroit, $33,240.

Michigan—H. G. Oakes, div. engr., Plymouth, widening grade, lengthening drainage structures, concrete paving 6.531 mi. MO33-37C-1, Ingham Co., for State Hy. Comn., Lansing, to J. A. Mercier Co., 450 West Fort St., Detroit, $100,-274. Noted Nov. 5.

Michigan—J. T. Sharpensteen, div. engr., Escanaba, grading drainage structures 4.311 mi. FO36-18C-1, Iron Co., for State Hy. Comn., Lansing, to Alfred Lindberg, Ishpeming, $36,-996. Noted Nov. 12.

Minnesota—State Hy. Dpt., St. Paul, improving 18 mi. S.P. 2-34, Div. B, F.A.P. 386-A, S.P. 2-28, Sect. 1, F.A.P. 86 and S.P. 2-28, Sect. 2, F.A.P. 416-C, to S. J. Reader & Co., 325 Kasota Bldg., Minneapolis, $286,724—17.5 mi. S.P. 2-40, Sect. 1, Div. A, F.A.P. 416-B, to A. Johnson Constr. Co., 1409 Foshay Tower, Minneapolis, $298,614—11.5 mi. S.P. 2-40, Sect. 1, Div. B, F.A.P. 416-B and S.P. 2-40, Sect. 2, F.A.P. 416-A, to Fielding & Shepley, 216 University Ave., St. Paul, $189,334—7.7 mi. S.P. 3-60, Sect. 2, F.A.P. 11 and S.P. 3-60, Sect. 3, F.A.P. 19, to McKenzie & Kileen, Superior, Wis., $98,461—21.4 mi. S.P. 7-23, F.A.P. 408-B, S.P. 7-44, F.A.P. 408-C, and S.P. 7-27, Sect. 2, F.A.P. 408-D, to C. F. Sculley Equipment Co., 212 Dakota Bldg., St. Paul, $356,126—16.4 mi. S.P. 8-38, Div. B, F.A.P. 204, S.P. 8-35, F.A.P. 431, and S.P. 8-27, Div. A, F.A.P. 249, to Central States Constr Co., 5324 Washburn Ave. S., Minneapolis, $353,653—16.4 mi. S.P. 20-36 F.A.P. 97, to Nolan Bros., 18 North 2nd St., Minneapolis, $330,468. Grand total $1,913,380. Noted Oct. 22.

Missouri—State Hy. Dpt., Jefferson City, to County Forces, grading 4.981 mi. Franklin Co. $1,295; 3.973 mi. Jefferson Co. $719—to State Forces, 4.432 mi. Phelps Co. $9,199; 3.163 mi. Sect. 1, Cassville-East Rd., $12,327; 4.792 mi. same road, Sect. 2, $9,250; 2.956 mi. Sect. 3, same road, $5,668; 3.409 mi. Sect. 1, Cassville-South East Rd., $16,194; 3.619 mi. Sect. 2, same road, $48,729, all Barry Co.—to Division Maintenance Forces, 2.47 mi. Scott Co., $3,372; 4.991 mi. Sect. 1 Ava Rd., Southwest, $15,574; 4.905 mi. same road, Sect. 2, $18,949, both Douglas Co.; 4.451 mi. Sect. 3 Lebanon-Plato Rd., $11,245; 3.523 mi. Sect. 4 same road, $9,921, both Laclede Co.; 4.515 mi. Sect. 28A Salem-Eminence Rd., $12,187; 4.335 mi. same road, Sect. 29A, $11,351, both Shannon Co. Grand total $185,980. No bids received.

Mo., Independence—Jackson Co., Court House, concrete paving 2.224 mi. Lee's Summit Connecting Rd., to W. A. Ross Constr. Co., 25th and Summit Sts., Kansas City, $46,895—7.95 mi. Noland St. Rd. and 3.759 mi. Blue Ridge Cut-off Rd., to Davis Constr. Co., Boonville, $205,-865 and $111,571 respectively—Noland St. Bridge, 110 ft. long, steel, concrete piers, etc., to Whitmore Constr. Co., 710 Midland Bldg., Kansas City, $14,003. Grand total $378,334.

Montana—State Hy. Comn., Helena, grading 11.954 mi. Madison Co. and 4.134 mi. Musselshell Co., to Tomlinson-Arkwright Constr. Co., Great Falls, $76,640 and $48,262 respectively—16.462 mi. Dawson Co., to F. C. and D. Constr. Co., Billings, $55,123—22.188 mi. F.A.P. 86A, Section, to Western Bridge & Constr. Co., 3967 Leavenworth St., Omaha, Neb., $92,204—bridges in Madison Co., to W. K. Trippitt, Whitefish, $3,692—in Dawson Co., to Dakota Concrete Co., Minot, N. D., $22,015—in Musselshell Co., to A. E. Lyle Co., Billings, $4,594. Grand total $303,530. Noted Nov. 5.

New York—See "Grade Crossings."

New York—A. W. Brandt, comr. Hys., State Office Bldg., Albany, grading, structures 6.38 mi. Onondaga Co., to Beale Constr. Co., Inc., Buffalo, $114,985 est. $168,633—concrete and bituminous macadam reconstructing 0.52 mi. Herkimer and Fulton Counties, to M. R. Ingraham, Inc., 11 South Lake Ave., Albany, $88,543 est. $115,573—0.94 mi. Westchester Co., to Luciano, Inc., White Plains, $67,137 est. $88,570—bituminous macadam repaving 0.37 mi. Otsego Co., to G. Edgecomb Co., Inc., Walton, $15,763 est. $23,582—concrete repaving 9.09 mi. Rensselaer Co., to C. Hansen, Troy, $348,835 est. $495,100. Grand total $635,-263. Noted Nov. 5.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., to W. P. MacDonald, 7 Lawrence St., Flushing, asphalt paving 60th St., $3,615; Penrod St., Beech Ave., $9,650; $8,253; 103rd Ave. $14,442; 50th St. $9,736—to Pomonok Asphalt Paving Co., 1246 Grand St., Brooklyn, 77th St. $11,119; 111th Ave. $73,229; 62nd Rd. $6,408; 95th Ave. $3,914; 129th St. $4,695; 133rd St. $9,592; Flushing Ave. $18,099—to Cleveland Trinidad Asphalt Co., Flushing, 11th St., $19,636—to Gramaglia Eng. Co., 5037 Fieldston Ave., New York, grading 111th St. $3,162—to P. K. Kelly, 3009 Woodside Ave., Woodside, Balstyne Ave $5,060—to M. Cafazzo, 1043 36th St., Brooklyn, 115th Rd., $4,903. Grand total $205,513. Noted Nov. 19.

N. Y., New York—H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Ave., to Tosti Constr. Co., 2324 Cambreling Ave., grading Bussing Ave. $2,377—to F. Mascali, 645 East Tremont Ave., Kennellworth Pl. $4,401; Dwight Pl. $7,080; Barclay Ave. $2,279; Tiemann Ave. $5,350—to Kane Haulage Corp., 660 East 149th St., sidewalks $663; regulating Barkley Ave. $6,174. Grand total. $28,324. Noted Nov. 19.

N. Y., New York—S. Levy, pres. Manhattan Boro, Municipal Bldg., grading, asphalt paving East 49th and West 79th Sts., to Venetian Contg. Co., 2 Lafayette St., $7,163 and $18,796 respectively. Noted Nov. 19.

N. Y., New York—S. Levy, pres. Manhattan Boro, Municipal Bldg., asphalt paving Attorney and 53rd Sts., to C. D. Beckwith, Inc., Seneca Ave. and Edgewater Rd., $4,004 and $9,979 respectively. Noted Nov. 12.

O., Cincinnati — Grading, concrete curbing, concrete guttering, cement sidewalks, concrete paving 8,900 sq.yd. Paddock Rd. from Seymour Ave. to 73rd St., to Andrews Asphalt Co., Greenville Ave., Glendale, $30,357. Est. $38,345.

O., Cleveland — New York, Chicago & St. Louis R.R. Co., A. C. Harvey, ch. engr., Terminal Tower, 4 in. vitr. brick, wood block and sheet asphalt paving Woodland Ave. Bridge, to Enterprise Paving & Constr. Co., 8436 Bway. Est. $25,000.

Pa., Allentown—Raleigh Co., resurfacing roadway and portion sidewalk on Hamilton St. Bridge, to G. H. Hardner, Lentz Bldg., $55,528. Est. $62,000. Noted Nov. 27.

South Dakota—State Hy. Comn., Pierre, to Lindekugel & Kolberg, Spencer, grading, graveling 7.115 mi. Brookings-Volga Rd., U. S. 14 Brookings Co. $2,275; 15.056 mi., U. S. 14, Iroquois-Demett Rd., Kingsbury Co. $3,322—to Wiley-Lein Constr. Co., Summit, 15.102 mi. McLaughlin to Wakpala, U. S. Hy. 12, Corson Co. $12,852; 17.108 mi. U. S. 85, North of Belle Fourche, Butte Co. $10,282; 28.705 mi. State Rd. 73, $9,871—to Northwestern Eng. Co., Rapid City, 17.896 mi. State Hy. 24, Sturgis to Belle Fourche River, Meade Co. $9,987—to S. S. Roberts, Flandreau, 18.347 mi. U. S. Hy. 14, Miller to West Hand Co. line, Hand Co., $7,558; 12.366 mi. State Hy. 34, Lake Co., $4,581—to D. C. Schryer, Weshington Springs, 16.461 mi. State Hy. 34, Artesian to Junction, Sanborn Co., $4,150—to Richer & Schkechet, Parker, 9.882 mi. Worthing to Lenox, Lincoln Co. $1,953; 18.832 mi. State Hy. 50, from west of Wagner to east Charles Mix Co. line, Charles Mix Co., $4,368. Grand total $70,899.

Street and Roads (Continued)

Texas—G. Gilchrist, state hy. engr., Austin, concrete paving 8.525 mi. Houston Co., to R. W. Briggs & Co., Pharr, $138,590 e.e. $160,000—triple bituminous on caliche base surface treating 17.189 mi. Lubbock and Hockley Counties, to Cocke & Braden, Marshall, $180,130 e.e. $126,000—concrete paving 7.841 mi. Liberty Co., to Froemming Bros., Inc., of Texas, Needville, $132,698 e.e. $140,000—3.965 mi. Navarro Co., to F. P. McElwrath Constr. Co., Corsicana, $65,287 e.e. $76,000—7.024 mi. Houston Co., to L. H. Lacy Co., 202 Burt Bldg., Dallas, $106,318 e.e. $120,000—½ in. limestone rock asphalt on gravel surface treating 33.763 mi. Uvalde Co. and traffic bound broken stone base course surfacing 10.994 mi. Jack Co., to Dexter Constr. Co., Hangar 10, Love Field, Dallas, $70,040 and $92,849 respectively e.e. $110,000 and $90,000 respectively—grading, drainage structures, concrete paving 1.938 mi. Tarrant Co., to West Texas Constr. Co., 501 East Rosedale St., Fort Worth, $66,200 e.e. $88,000—grading, concrete drainage structures 16.674 mi. Robertson Co., to Hannah Constr. Co. and F. and D. Hall, Box 994, Waco, $63,983 e.e. $76,000—triple asphalt on caliche, water bound broken stone macadam base course surface treating 13.676 mi. Brown Co., to H. K. McCollum, Fort Worth Natl. Bank Bldg., Fort Worth, $115,612 e.e. $140,000—crushed conglomerate course surfacing 6.409 mi. Wise Co., to J. Lee and E. A. Vilbig, Inc., 2517 Eakin St., Dallas, $38,322 e.e. $60,000, all foregoing 18 ft. wide—grading, drainage structures 9.901 mi. Wilson Co., to J. M. Shilling, Itasca, $42,340 e.e. $50,000—6.923 mi. Crockett and Pecos Counties, to L. J. Miles, 1809 Clover Lane, Fort Worth, $31,427 e.e. $40,000—14.268 mi. Hopkins Co., to Womack, Henning Constr. Co., Sherman, $32,845 e.e. $56,000—6.259 mi. Fayette Co., to E. G. Powell, Box 688, Jacksonville, $24,937 e.e. $25,000—14.907 mi. Bexar Co., to McClure & Denison, Tucumcari, N. M., $54,420 e.e. $64,000—9.575 mi. Harrison Co. and 13.343 mi. Guadalupe Co., to Trinity Farm & Gravel Co., Box 1428, Dallas, $33,660 and $91,630 respectively e.e. $28,000 and $76,000 respectively. Grand total $1,309,288. Noted Nov. 26.

Ontario—Dpt. Northern Development, Parliament Bldgs., Toronto, clearing, grading, drainage, ditching, graveling 40 mi. trunk road from Bracebridge to Menden, day labor. $500,000. J. Sinton, Parliament Bldgs., Toronto, engr.

EXCAVATION, DRAINAGE, IRRIGATION, LEVEES, RIVER AND HARBOR

PROPOSED WORK

Mass., Winthrop—Commonwealth of Massachusetts, Metropolitan Dist. Comn., 20 Somerset St., Boston, increasing height of sea wall, 2 spur jetties, rip rap, additional drainage and catch basins, for shore protection. Shore Dr. $150,000.

Tex., Orange — Orange Co. Conservation & Drainage Dist., soon takes bids drainage project, incl. levees, channel straightening, removing obstructions, bars, etc., to protect over 22,000 acres land in northeast part county. $565,000. Address District Board. Noted Oct. 8.

BIDS ASKED

Ill., East St. Louis—Dec. 28, by Bd. Trustees East Side Levee & Sanitary Dist., 213 Metropolitan Bldg., furnishing, placing revetment on levee Constr. Project 7, incl. 25,000 sq.yd. revetment in place, 2,000 cu.yd. excavating for footings, grading levee, also Hy. Bridge 2, over Constr. Project 8, incl. 130 ft. riveted through truss central span, two 65 ft. riveted pony truss approach spans, rein.-con. piers, abutments, 22 ft. roadway, double 10 x 5.5 ft. rein.-con. culvert, 90 ft. long, with wing walls for Auxiliary 1, Constr. Project 8, State Aid Route 39. E. F. Harper, c/o owner, engr.

Bond Elections

Coming Bond Elections

Waterworks Extensions—Lynwood, Calif., $125,000. A. J. Bateman, city engr.

Increasing Water Supply—Paso Robles, Calif., exceeds $15,000. H. Johnson, city engr.

Sewers—Springfield, Mo., Northwest Sewage Disposal Plant, Dec. 23, $200,000.

Bonds Voted

Filtration Plant, Intake, etc.—Wilmette, Ill., $600,000. Pearse, Greeley and Hanson, engrs.

Waterworks Add.—New Sharon, Ia., $15,000. T. H. Eckloff, town clk.

Waterworks—New Castle, Wyo., $20,000.

High School — Claremont, Calif., High School Dist. $148,000.

FEDERAL GOVERNMENT

PROPOSED WORK

Arkansas and Tennessee—CONCRETE WALL, etc.—U. S. Eng. 1006 McCall Bldg., Memphis, Tenn., 1,800 ft. concrete wall on sheet piling across entire river front of depot, $90,000; levees north and west sides depot to height about 50 ft. on Memphis, Tenn., river gage, incl. 200,000 cu.yd. earth, $35,693; retaining wall and flood gate at railroad opening to Bridge Junction, Ark., $4,000.

Calif., Mare Island—BATTERY OVERHAUL SHOP—Yards & Docks, Navy Dpt., Wash., D. C., battery overhaul shop at Mare Island Navy Yard. $240,000. **Maturity after Jan. 1.**

Fla., Bradenton—POST OFFICE—Treas. Dpt. at office Sup. Archt., Wash., D. C., U. S. Post Office. $155,000.

Ind., Whiting—POST OFFICE—Treas. Dpt. at office Sup. Archt., Wash., D. C., U. S. Post Office, 119th St. and New York Ave.

Minnesota—POWER HOUSE—U. S. Eng., St. Paul, rein.-con. power house at Twin City Locks.

Minn., St. Paul—PIERS—U. S. Eng., 10 rein.-con. piers, in Hastings Pool area on Mississippi River above Hastings lock and dam.

Minnesota — ROAD — U. S. Forestry Serv., Wash., D. C., bids in summer, widening, straightening 6 mi. Grand-Marais-Seagull Lake Trail, Superior National Forest, Cook Co. $40,000.

N. M., Albuquerque—HOSPITAL—U. S. Bureau Indian Affairs, 3 story, basement hospital, incl. doctors quarters, nurses' home and employees and garage building near University of New Mexico. $375,000 appropriated. L. A. Towers, supt. Southern Pueblo Agency, Albuquerque, in charge.

N. J., Lakehurst—STORAGE BUILDING—Yards & Docks, Navy Dpt., gas cell storage building. $200,000.

N. J., Phillipsburg—POST OFFICE—Treas. Dpt. at office Sup. Archt., Wash., D. C., plans by F. R. Hann, 23 Summit Ave., 2 story, basement, brick, steel, Hillcrest Blvd. and Morris St. $155,000. J. A. Wetmore, c/o owner, superv. archt. Noted Nov. 26.

Okla., El Reno—MESS HALL, etc.—Treas. Dpt. at office Sup. Archt., soon takes bids 2 story, part basement, 161 x 185 ft. mess hall, $225,000; 2 story, basement, concrete, brick, stone or terra cotta power plant, $145,000. Former bids rejected. Noted Oct. 8.

Pa., Stroudsburg — POST OFFICE — Treas. Dpt. at office Sup. Archt., Wash., D. C., plans by Craig & Kiefer, Stroudsburg, and J. H. DeSibour, consult. archt., 1200 15th St. N. W., Wash., D. C., U. S. Post Office.

R. I., Melville—TANK—Spec. 6681—Yards & Docks, Navy Dpt., Wash., D. C., rejected bids Nov. 18, 90,000 gal. steel tank. Noted Nov. 12.

Wyo., Douglas — FEDERAL BUILDING — Treas. Dpt. at office Sup. Archt., sketches federal building. $65,000.

Wyo., Torrington — FEDERAL BUILDING — Treas. Dpt. at office Sup. Archt., Wash., D. C., sketches federal building. $90,000.

T. H., Pearl Harbor—OVERHAUL SHOP—Yards & Docks, Navy Dpt., Wash., D. C., soon takes bids new engine overhaul shop. $200,000. Noted Feb. 19.

BIDS ASKED

Ark., Hot Springs—HOSPITAL—Jan. 20, at office Con. Q.M., hospital, at Army and Navy General Hospital; adv. E. N.-R. Dec. 10. Noted Dec. 3.

Calif., Long Beach—FEDERAL—Jan. 5, by Treas. Dpt. at office Sup. Archt., Wash., D. C., U. S. Post Office. $765,000. Noted Apr. 9.

Calif., San Francisco—HOSPITAL—Jan. 8, by Treas. Dpt. at office Sup. Archt., Wash., D. C., 4 double officers quarters, officer in charge residence, garage attendant's and storage building, recreation building laboratory and storage building at U. S. Marine Hospital.

Fla., Miami—DREDGING—Dec. 29, by U. S. Eng., Jacksonville, 1,175,000 cu.yd. place measurement in Miami River; adv. E.N.-R. Dec. 10.

Kan., Topeka—POST OFFICE—Jan. 4, by Treas. Dpt. at office Sup. Archt., Wash., D. C., U. S. Post Office; adv. E.N.-R. Dec. 10.

Louisiana—DREDGING—Jan. 5, by U. S. Eng., 1st New Orleans Dist., Poland and Dauphine Sts., New Orleans, 6,554,100 cu.yd. in Louisiana and Texas Intracoastal Waterway, Mississippi River-Atchafalaya River Sect. from Harvy to Bayou Blue; adv. E.N.-R. Dec. 10.

Mont., Butte—ELEVATOR—Dec. 23, by Treas. Dpt. at office Sup. Archt., Wash., D. C., freight elevator in U. S. Post Office and Court House.

N. Y., Brooklyn—MACHINE TOOLS, etc.—Dec. 15, by Bureau Supplies, Navy Dpt., Wash., D. C., machine tools, threading tools, electric drills, grinders, arc welding sets to Brooklyn Navy Yard.

O., Youngstown—POST OFFICE—Dec. 28, by Treas. Dpt. at office Sup. Archt., Wash., D. C., U. S. Post Office; adv. E.N.-R. Dec. 10.

S. C., Ezell—MONUMENT—Dec. 21, at office Con. Q. M., Fort Bragg, N. C., monument at Cowpens Battlefield, near here; adv. E.N.-R. Dec. 10. Noted Nov. 5.

Tex., Texas City—POST OFFICE—Jan. 4, by Treas. Dpt. at office Sup. Archt., Wash., D. C., U. S. Post Office; adv. E.N.-R. Dec. 10.

Utah, Salt Lake City—GAS DISTRIBUTING LINES, etc.—Dec. 16, by Vet. Bu., Arlington Bldg., Wash., D. C., gas distributing lines, gas and oil burning equipment, piping valves, pipe covering, regulators, fuel oil tank, concrete founds., oil pumps, strainers, heaters, traps, meters, oil burners, gas burners, motors, controllers for U. S. Veterans Hospital. Superv. Superintendent of Constr., Veterans Administration Bldg., Palo Alto, Calif., in charge.

Virginia—DREDGING—Jan. 8, by U. S. Eng. Norfolk, approximately 23,633 cu.yd. in Nansemond River; adv. E.N.-R. Dec. 10.

Wash., Prosser—CANAL—Spec. 547-D—Dec. 30, at office Bureau Reclamation, Dpt. Interior, Yakima, Wash., D. C. Prosser power canal, Prosser power plant and altering Prosser diversion dam, Kennewick Div., Yakima Project, near here. E. Mead, constr., adv. E. N.-R. Dec. 10.

Wis., Wisconsin Rapids—POST OFFICE—Dec. 30, by Treas. Dpt. at office Sup. Archt., Wash., D. C., U. S. Post Office; adv. E. N.-R. Dec. 10.

Wyo., Newcastle—FEDERAL—Dec. 30, by Treas. Dpt. at office Sup. Archt., Wash., D. C., U. S. Post Office; adv. E.N.-R. Dec. 10. Noted July 23.

CONTRACTS AWARDED

Arizona—ROAD—Pub. Rds., Phoenix, grading, draining 6.322 mi. Oak Creek Natl. Forest Hy., Coconino Natl. Forest, Coconino Co., to Utah Constr. Co., Ogden, Utah, $147,000. Noted Nov. 18.

Calif., Sacramento—WEIR—U. S. Eng., concrete weir at Moulton Landing, to Lord & Bishop, Native Son's Bldg., Sacramento, $82,942. Noted Apr. 30.

Fla., Jacksonville—POST OFFICE—Treas. Dpt. at office Sup. Archt., Wash., D. C., U. S. Parcel Post Office, to J. I. Barnes, Logansport, Ind., $286,880. Noted Oct. 1.

Illinois—DREDGING—U. S. Eng., St. Louis, Mo., 80,000 cu.yd. Alton Slough, to LaCrosse Dredging Co., 405 Plym Bldg., Minneapolis, Minn., $19,800.

Kan., Fort Riley—REFRIGERATION PLANT—Con. Q. M., refrigeration plant in commissary building, to Baker Ice Machine Co., Inc., 3601 North 16th St., Omaha, Neb., $7,200.

La., Shreveport—DRAINAGE SYSTEM—Con. Q. M., Barksdale Field, storm water drainage system at Barksdale Field, to Kirkwood, Wharton & Lee, 523 North Flores St., San Antonio, Tex., $77,816. Noted Oct. 22.

Missouri—CLUMP PIKES—U. S. Eng., 428 Custom House, St. Louis, 5,700 ft. standard pile clump dikes in Missouri River at Pelican Bend, to Bilhorn, Bowers & Peters, Inc., Railway Exch. Bldg., St. Louis, $163,400. Noted Oct. 22.

Mo., Kansas City—WOOD PILES, etc.—U. S. Eng., 707 Postal Telegraph Bldg., 1,000 pcs. wood piles, to K. and K. Timber Co., Seattle, Wash., $24,233; one steam hoister, to Farquhar Co. Ltd., Kansas City, $664; 1 steel pump house, to Butler Mfg. Co., 7100 East 13th St., Kansas City, $469. Grand total $25,357.

Okla., Fort Sill—HANGAR—Con. Q.M., new airplane hangar, to F. B. Hannan, Lawton, $50,200. Est. $55,000. Noted Oct. 22.

Okla., Sapulpa—POST OFFICE—Treas. Dpt. at office Sup. Archt., Wash., D. C., U. S. Post Office, to Holmboe Constr. Co., 420 West 2nd St., Oklahoma City, $76,500. Noted Nov. 5.

S. C., Columbia—PLUMBING—Treas. Dpt. at office Sup. Archt., Wash., D. C., plumbing, electrical work, heating at U. S. Veterans Hospital, to Virginia Eng. Co., Newport News, Va., $260,500. Noted Dec. 3, under "Contracts Awarded."

Tenn., Memphis—BRUSH and POLES—U. S. Eng., McCall Bldg., 10,000 cords brush and poles, to C. W. Hunter Co., 177 South Front St., at $1.97 per cord, total $19,700. Noted Nov. 5.

Tenn., Memphis—EARTHWORK—U. S. Eng., Memphis, 20,050 cu.yd. earthwork in Bird's Point New Madrid Floodway Levee, in Missouri River, to Lahar Constr. Co., Boonville, at $0.24 per cu.yd.; 8,000 cu.yd. same levee, to C. J. Fugate, East Prairie, $0.25; furnishing 20,000 tons stone loaded on government barges at Helena, Ark., to W. E. Womble, Fort Smith, Ark., at $1.48 per ton; 200,000 lb. 4 in. galvanized wire strand, to Broderick & Bascom Rope Co., 4203 North Union Blvd., St. Louis, Mo.

Wis., LaCrosse—EXTENDING, etc.—Treas. Dpt. at office Sup. Archt., Wash., D. C., extending, remodeling U. S. Post Office, Court House, to McGough Bros., 244 Prior Ave. S., St. Paul, Minn., $162,800. Noted Oct. 15.

RAILWAYS

PROPOSED WORK

Pennsylvania—Reading Co., Reading Terminal Bldg., Phila., C. Tillenbeck, eh. engr., electrification 35 track mi. railroad from Phila. to Norristown. $1,500,000. **Maturity after Jan. 1.**

SUBWAYS AND TUNNELS

PROPOSED WORK

N. Y., Brooklyn—Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, plans 13.5 track mi. Grand St., South 4th St. and Beaver St. Line, incl. 2 tracks to Driggs Ave., 4 tracks to Union Ave., 8 tracks to Bushwick Ave., 4 tracks to Stuyvesant Ave., and 2 tracks Branch Bway. line East River to Havemeyer St. $34,800,000; 23.4 track mi. Stuyvesant Ave.-Utica Ave. line, 4 tracks Bway. to Flatbush Ave. $39,300,000; 2 1-5 track mi. Avenue S line-Utica Ave. to Nostrand Ave. $2,000,000; 5 1-5 track mi. Nostrand Ave. Line 4 tracks Ave. S. to Voorhees Ave., $3,200,000; 7 1-3 track mi. Liberty Avenue Line, 4 tracks East New York in Grand Aves. $13,500,000; 5 1-3 track mi. Myrtle and General Ave. Line 4 tracks on Bushwick to Palmetto Ave., $14,300,000. Above projects authorized and approved by Bd. Estimate. **Maturity late spring.**

N. Y., New York—Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., plans 2nd step program, under Water St., New Bowery, and Chrystie St. Line (Pine to Houston Sts.), incl. 4.68 track mi. subway, 2 tracks to Chambers St., 4 tracks to Houston St., $11,300,000; 6th Ave.-61st St. Line, 2.2 mi. 2 tracks 52nd St.

Constr. News page 211

Subways and Tunnels (Continued)

and 6th Ave. to 61st St. and 2nd Ave., $6,700,000; Worth St., East Bway., Grand St. Line, 3.9 mi. 2 tracks Church St. to East River, $13,300,000; Houston St. Line, 1.9 mi. 2 tracks Essex St. to East River, $7,900,000. Above projects authorized and approved by Bd. Estimate. **Maturity early spring.**

GRADE CROSSINGS

PROPOSED WORK

O., Cleveland—See "Bridges."

Ont., Fort William—City subway under railroad tracks at James St., incl. concrete retaining walls, abutments, structural steel, $50,000. C. B. Symes, City Hall, engr.

Ont., Riverside—Town and Sandwich East Twp. subway, concrete or steel deck, incl. concrete footings, retaining walls, abutments under Canadian National Ry. at Jefferson Blvd. $100,000. G. G. Reed, Riverside, engr.

BIDS ASKED

Ont., Oakville—Dec. 15, by T. T. Irving, ch. engr. (Central Region), Canadian Natl. Ry., New Union Sta., Toronto, concrete, structural steel subway, on 7th line, here, for Town and Canadian Natl. Ry. $50,000. R. F. Smith, Oakville, town engr.

CONTRACTS AWARDED

New York—New York Central R.R. Co., F. B. Freeman, ch. engr., 466 Lexington Ave., New York, 900 ft. tunnel for eliminating grade crossings on Beacon-Bear Mountain Hy., Dutchess-Putnam County line, to Walsh Constr. Co., Herald Bldg., Syracuse, $208,456.

N. Y., Whitehall—Hecker Moon Co., contractor, 8701 Union St., Cleveland, O., 1,000 tons sheet piling for eliminating Boardman, Main, Church and Bellamy Sts. crossings, to Bethlehem Steel Co., 39 Bway., New York, for Delaware & Hudson R.R. Co., J. Mac Martin, ch. engr., Albany. Noted Nov. 26.

DAMS

PROPOSED WORK

Tex., Burnet—Central Texas Hydro-Electric Co., Seguin and Burnet, acquired all properties incl. dam under construction in Burnet and Llano Counties and sites for 5 other proposed dams on Colorado River, formerly owned by Emery, Peck & Rockwood Development Co., 208 South La Salle St., Chicago, Ill., F. A. Dale, mgr., headquarters at Hamilton Dam near Burnet. $8,000,000. Noted Apr. 23, under "Contracts Awarded."

BIDS ASKED

Okla., Hobart—See "Waterworks."

PIERS AND WHARVES

PROPOSED WORK

Calif., Oakland — PIER SHED — City Port Comm., Grove Street Pier, 1 story, rein.-con. extension to Transit Shed 2, on Outer Harbor, $100,000. Eng. Dpt. of owner, engrs.

BIDS ASKED

N. Y., New York—PIER—Dec. 14, by J. McKenzie, comr. Docks, Pier A, Battery Pl., pier, foot East 107th St., Harlem River, Manhattan Boro. Contr. 1980.

CONTRACTS AWARDED

Massachusetts—PIERS, etc.—City of Boston Dpt. P. Wks., repairing North and South Ferry Piers, Boston and East Boston, to R. B. Rendle & Co., Inc., 364 Border St., East Boston, est. $25,060; oil burning equipment, heating plant, Commonwealth Pier 5, South Boston, to Buckley & Scott, 1399 Boylston St., Boston, $11,816.

N. Y., Brooklyn — PIER SHED, etc. — Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., concrete deck piershed, to Meads Eng. Co., 217 West 14th St., New York, $168,600; pile and timber work, to Pierce Steel Pile Co., 44 South St., New York, $86,010; removing existing pier, to Morris & Cummings, 44 Whitehall St., New York, $34,020. Grand total $288,630. Noted Nov. 12.

AIRPORTS

PROPOSED WORK

Ia., Des Moines—Boeing Air Transport, Inc., Cheyenne, Wyo., hangar at airport, $35,000. Private plans.

Okla., Oklahoma City—M. Peshek, Jr., city clk., rejected bids Nov. 24, airport hangar, $25,000. A. R. Losh, City Hall, engr.

BIDS ASKED

Mass., Natick—See "Contracts Awarded."

CONTRACTS AWARDED

Mass., Natick—Natick-Wellesley Airport Co., Worcester St., Hangar 2, 1 story, steel, to Priggin Steel Building Co., 1 Carlton St., Cambridge; grading for construction of flying field, by day labor.

POWER AND LIGHTING

PROPOSED WORK

Iowa—Iowa Electric Co., Cedar Rapids, 10 mi. transmission line in Johnson Co.

N. J., Kearny (sta. Arlington)—Joint Bd. Freeholders Hudson Co. (Jersey City) and Union Co., Elizabeth, furnishing, installing traffic lighting system on Belleville Turnpike, $25,000. **Maturity soon.** F. J. Radigan, Court House, Jersey City, co. engr.

N. J., Roselle—Owner, c/o F. F. Durang, archt., 110 West Dudley Ave., Westfield, 1 story, 65 x 150 ft. church, plain found. $150,000.

BIDS ASKED

Minn., Spring Valley—Dec. 15, by Village, J. Osterud, clk., electric power and distributing system, incl. power house, 3 Diesel generating units, distribution lines, $25,000 or more.

New York—Dec. 18, by Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, furnishing, installing station and tunnel lighting equipment incl. electric heating and ventilation, for Independent System City owned subways from 8th Ave., Manhattan Boro, to 36th St., Queens Boro and from Court Sq., Queens Boro to Nassau Ave., Brooklyn Boro.

N. Y., Dongan Hills—Dec. 14, by J. G. W. Greeff, comr. Hospitals. Municipal Bldg., New York, fire alarm system in buildings Sea View Hospital, Brielle Ave. C. B. Meyers, 31 Union Sq., New York, archt.

CONTRACTS AWARDED

N. Y., Albany—Superintendent P. Wks., Capitol Bldg., Albany, electrical work, replacing cable, electric wiring, electric lighting and electric equipment for east section Capitol Building, to E. G. May, 51 Central Ave., $47,485. Noted Nov. 5.

PARKS AND SPORTS

PROPOSED WORK

Fla., Tampa—East Tampa Bay Co., Tampa, advanced Hillsborough Co. $6,000 to cover cost of election to see if voters will approve erection dog and horse racing plant near 22nd St. Causeway. Est. $400,000.

Kan., Kansas City—Bd. Educ., G. A. Wilder, clk., soon takes bids concrete stadium at Sumner High School.

Mass., Medford—City, Park Comm., W. Fay, ice hockey rink. To exceed $25,000.

Mass., Worcester—City, School Dpt., City Hall, stadium field house at Public Schools Athletic Field. $50,000.

N. J., Teaneck—Bd. Educ., High School, preliminary plans stadium and athletic field at rear high school, Queen Ann Rd. $50,000.

N. J., Union City—Bd. City Comrs., City Hall, bids in April on revised sketches 4 movable grandstands, tennis courts, miniature golf course. $250,000. G. W. Thompson, 324 Montgomery St., Syracuse, N. Y., archt. H. Thourot, 708 Bergenline Ave., engr. Noted Apr. 2.

N. J., West New York—Bd. Town Comrs., Municipal Bldg., improving playground, incl. retaining walls, skating pond, concrete walks, Jackson St. $25,000 or more. F. Olieri, 650 Bergenline Ave., town engr. **Maturity soon.**

N. Y., Farmingdale—Lenox Hills Golf Club, golf course and club house. To exceed $40,000.

Tex., College Station—A. & M. College, rein.-con. swimming pool. T. E. Giesecke, college archt.

Ont., Toronto—City Council improving eastern beaches, incl. two 400 ft. wood bleachers, boardwalk, grading. $110,000. R. C. Harris, City Hall, engr.

BIDS ASKED

R. I., Providence — Dec. 14, by City, Park Div., improving Roger Williams Park. $25,000 or more.

CONTRACTS AWARDED

Mass., Boston—City of Boston, Park Dpt., 33 Beacon St., field house and playground reconstruction, Moreland St. Playground, Roxbury, to Fritz Constr. Co., 62 Maywood St., Roxbury. Est. $25,000.

N. Y., Brooklyn—Park Bd., W. R. Herrick, pres. Park Dpt., Arsenal Bldg., Central Park, New York, additional development McKinley Park, to Independent Fence Co., 189 7th St., $14,390; general improvement City Park, to Norvine Contg. Co., Inc., 629 Albany Ave., $31,925. Noted Nov. 19.

N. Y., New York—Park Bd., W. R. Herrick, pres. Park Dpt., Arsenal Bldg., Central Park, general contract tennis house, Crotona Park, to A. Spadaro, Inc., 724 East 225th St., $29,781; plumbing, to Forsyth Plumbing & Heating Co., 153 Baxter St., $4,361; heating, to Lossack Gaynor Corp., 119 Prospect St., Long Island City, $1,844. Grand total $35,980. Noted Nov. 5.

HEATING AND VENTILATING

PROPOSED WORK

N. Y., New York—Owner, c/o M. Siegel, archt., 1775 Bway., replacing heating, plumbing electrical work, in storage and restaurant. $40,000.

BIDS ASKED

N. Y., Dongan Hills—Dec. 15, by J. G. W. Greeff, comr. Hospitals, Municipal Bldg., New York, installing steam heating system from power house to cottages A, B, C, D and E, at Seaview Hospital. Sibley & Featherston, 205 East 42nd St., New York, archts. Noted Nov. 26.

CONTRACTS AWARDED

Mass., Norfolk—Dpt. Correction, furnishing, erecting new boilers at State Prison Colony, to International Eng. Wks., Framingham, $10,428; stokers, to Detroit Stokers Co., 201 Devonshire St., Boston, $8,392; coal handling equipment, to Colwell & McMullen, 31 St. James Ave., Boston, $7,937. Grand total $26,757. Noted Nov. 12.

Mass., Palmer — Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, electric work in boiler house at Monson State Hospital, to Lord Electric Co., 303 Columbus Ave., Boston, $12,890; coal handling equipment, to Colwell & McMullin, 31 St. James Ave., Boston, $11,985.

N. Y., Brockport—Commissioner Education, State Educ. Bldg., Albany, heating work, repairing and replacing, altering steam and return lines at New York State Normal School, to W. J. O'Connell, 336 Potter Rd., Buffalo, $15,384. Noted Oct. 29.

N. Y., Brooklyn—Bd. Educ., 500 Park Ave., New York, heating and ventilating in P.S. 236, to Lossack Gaynor Co., 119 Prospect St., Long Island City, $47,390; plumbing, to Tri-Boro Eng. Corp., Chatham Phoenix Bldg., Long Island City, $15,247; electrical work, to Oxford Contg. Co., 1440 Bway., New York, $12,337. Grand total $74,974. Noted Nov. 19.

UNCLASSIFIED

PROPOSED WORK

Colorado—PIPE LINE—Continental Oil Co., Continental Bldg., Denver, pipe line from Hardin to Denver. **Maturity indefinite.**

Colo., Hardin—LOADING RACK—See "Oklahoma and Colorado, under Contracts Awarded."

Fla., Tampa—LOADING DOCK—Standard Fruit & Steamship Co., 1001 Peninsular Bldg., banana unloading and a citrus loading dock, $50,000. Private plans by Company Engineers at Union Indemnity Bldg., New Orleans, La., office.

Ia., Des Moines—STORAGE TANK—Great Lakes Pipe Line Co., additional 17,500 bbl. storage tank. Private plans.

Ia., Marengo—BROADCASTING STATION—Central Broadcasting Co., 11th floor Liberty Bldg., Des Moines, D. Palmer, bus. mgr., Davenport central transmission station, near here. $125,000.

N. Y., Oswego — COAL DUMP — Delaware, Lackawanna & Western R.R. Co., J. G. Ray, ch. engr., Hoboken, N. J., coal dump for handling bituminous and anthracite coal. $475,000.

N. Y., Oswego—COAL SHIPPING PLANT—New York, Ontario & Western R.R. Co., W. C. Heidenthal, ch. engr., Middletown, improving coal shipping plant, incl. installing loading machinery, new docks.

Oklahoma and Colorado—STOCK YARDS—Atchison, Topeka & Santa Fe R.R. Co., 80 East Jackson Blvd., Chicago, Ill., G. W. Harris, ch. engr., building stock yards as follows, one 13 mi. north of Boise City, Okla., one at Campo, Okla., one 12 mi. north of Springfield, Colo., one 21 mi. north of Springfield, Colo., one 9 mi. south of Las Animas, Colo. **Maturity early in 1932.**

Oklahoma and Illinois—PIPE LINE—Marathan Oil Co., W. W. Fleming, pres., and Mid-Kansas Oil & Gas Co., Philtower Bldg., Tulsa, Okla., 700 mi. 12 in. c.i. oil pipe line from Drumright, Okla., to Woodriver, Ill. $6,500,000. Pipe not yet purchased.

Oklahoma and Texas—PIPE LINE—Texas Empire Pipe Line Co., Philtower Bldg., Tulsa, Okla., 300 mi. 12 in. pipe line from Lima Station (Seminole Co.) Okla., to East Texas Fields.

Pa., Meadville—CULVERT—City, S. Maxwell, clk., soon takes bids 2,500 lin.ft. 4 x 4 concrete block-culvert, Linden St. $50,000. R. Phillips, City Hall, engr.

Tex., Big Spring—MINING—J. B. Neel, Big Spring, leased 320 acre tract near here for mining purposes, and plans constructing lime kiln, probably by day labor. Private plans.

Ont., Pelee Island—OIL and GAS DEVELOPMENT WORK—Pelee Oil & Gas Co., E. Winter, Leamington, genl. mgr., plans extensive development work for oil and gas. Interested in prices all equipment.

BIDS ASKED

N. Y., Comstock—SERVICE TUNNELS—Dec. 17, by Commissioner Correction, State Office Bldg., Albany, service tunnels, Great Meadow Prison; adv. E. N.-R. Dec. 10.

N. Y., New York—PLUMBING—Dec. 15, by J. G. W. Greeff, comr. Hospitals, Municipal Bldg., brass hot and cold water supply systems and making certain plumbing alterations, furnishing, replacing certain plumbing fittings in pavilions A and B, and in nurses home, Bellevue Hospital, foot East 26th St.

Oklahoma and Colorado—PIPE LINE—See "Contracts Awarded."

CONTRACTS AWARDED

Colorado—PIPE LINE—Arkansas Valley Natural Gas Co., Rocky Ford, laying 10 mi. natural gas pipe line from Rocky Ford to Ordway and Sugar City, also 23 mi. line from Rocky Ford to Manzanola and to Fowler, to Western Constr. Co., 229 North Nogales St., Tulsa, Okla.

Constr. News page 212

Unclassified (Continued)

N. J., Princeton—PLUMBING—Coolidge, Shepley, Bulfinch & Abbott, archts., Ames Bldg., Boston, Mass., plumbing in laboratory of animal and plant pathology, to J. C. McMillan, Inc., 228 East 46th St., New York, for Rockefeller Institute, York Ave. and 66th St., New York. Noted Dec. 3.

N. Y., St. George—ASPHALT PLANT—J. A. Lynch., pres. Richmond Boro, Boro Hall, building to enclose asphalt plant, to Flood Eng. Corp., 186 Remsen St., Brooklyn, $20,860. Noted Oct. 29.

Oklahoma and Colorado—PIPE LINE—Continental Oil Co., Continental Bldg., Denver, Colo., 4 in. pipe line from Greasewood Field (Ponca City), Okla. to Hardin (Weld County), Colo., separate contracts. Soon lets contract loading rack at Hardin, Colo.

Texas—NATURAL GAS PIPE LINE—United Gas Pub. Serv. Co., Longview and Houston, A. D. Greene, ch. engr., extending mains from 5 or 6 towns between Longview and Henderson to serve interests in oil field area, probably use 6 in. pipe. $80,000. Owner builds.

Ont., Toronto—OIL STORAGE TANK—Harbor Petroleum Terminals, Ltd., installing 1 m.g. oil storage tank, to Horton Steel Wks. Ltd., Bridgeburg; founds. and pile driving, to Richardson Constr. Co., 10 East Adelaide St. E. Est. $50,000.

MATERIALS

BIDS ASKED

LUMBER, NAILS, etc.—**Corydon, Ia.**—Dec. 14, at office Auditor Wayne Co., 3,625 lin.ft. creosoted yellow pine piling, 2,880 ft. red cedar piling, 7,500 ft. B.M. creosoted Douglas fir caps, 160,612 ft. B.M. untreated No. 1 common Douglas fir lumber, also 2,500 lb. 50D and 2,600 lb. 60D nails. Address County Engineer or Auditor.

LUMBER, etc.—**Indianola, Ia.**—Dec. 15, at office Auditor Warren Co., 272,532 ft. B. M. untreated and 56,682 ft. B. M. treated fir lumber, 9,400 lin.ft. treated yellow pine piling. Address County Engineer or Auditor.

PIG LEAD—**Baltimore, Md.**—Dec. 16, by Bd. Awards, 250,000 lb. pig lead. L. Small, Bureau Water Supply, Municipal Bldg., engr.

WATERPROOFING FABRIC—**Boston, Mass.**—Dec. 14, by Transit Dpt., 1 Beacon St., 45,000 sq.yd. saturated water-proofing fabric.

LIME, etc.—**St. Louis, Mo.**—Dec. 14, by N. L. Meston, supply comr., City Hall, 20,000 tons more or less lime to be ordered during year ending Dec. 31, 1932, also 5,000 tons more or less sulphate of iron.

SULPHATE OF ALUMINUM—**St. Louis, Mo.**—Dec. 15, by N. L. Meston, supply comr., City Hall, 5,000 tons more or less sulphate of aluminum; 250,000 lb. more or less liquid chlorine, for use of Water Dpt. during year ending Dec. 31, 1932.

SLAG and TERRA COTTA PIPE—**Swissvale, Pa.**—A. Hutchinson, engr., 608 South Ave., Pittsburgh, in market slag and terra cotta pipe, will carry on work through Allegheny County Emergency Assn. Redressing, resetting stone curbs, constructing 6,000 ft. 8- to 20-in. terra cotta sewer. $30,000.

CASTINGS—**Providence, R. I.**—Dec. 14, by Sewer Dpt., City Hall, special castings as specified.

CONTRACTS AWARDED

LUMBER—**Minneapolis, Minn.**—F. S. Gram, city purch. agt., City Hall, 25,000 bd ft. basswood, to J. H. Rowe, 834 Lumber Exchange, $1,415; 18,000 ft. red oak, to Prestholdt Lumber Co., 4301 East Lake St., $1,782; 28,500 ft. redwood, to Bennett Bailey Lumber Co., 1335 Central Ave., $2,029. Grand total $5,166.

PIPE—**Minneapolis, Minn.**—F. S. Gram, city purch. agt., 2,000 lin. ft. 12 in. centrifugal c.i. pipe, to Amer. C. I. Pipe Co., 712 Plymouth Bldg., Minneapolis at $1.335 per ft. Noted Nov. 12.

GRAVEL—**Lincoln, Neb.**—State, c/o State Purchasing Agent, State Capitol, 3,000 tons gravel to be used in Dakota Co., to Central Bridge & Constr. Co., Wahoo, at $1.78 per ton.

STEEL—**Preakness, N. J.**—Bd. Freeholders Passaic Co., Court House, Paterson, furnishing, constructing structural steel for welfare county home, to J. K. Cooke & Sons, 210 Clifton Blvd., Clifton, $25,685. Noted Oct. 15.

CONCRETE—**St. George, N. Y.**—J. A. Lynch, pres, Richmond Boro, Boro Hall, 300 tons concrete, to C. Vanderbilt, 24 Elizabeth St., West New Brighton, $4,500. Noted Nov. 19.

PIPE—**Rapid City, S. D.**—To Merritt & Starmer, Rapid City, 3,600 lin ft. 12 in. pipe at $0.45 per ft., 4,550 ft. 15 in. $0.56, 8,700 ft. 18 in. $0.73, 3,700 ft. 21 in. $0.94, 800 ft. 24 in. $1.07, to South Dakota Concrete Products Co., Watertown, 200 ft. 8 in. at $0.28, 1,275 ft. 10 in. $0.36. Noted Oct. 29, under "Sewers."

SWITCHES, CIRCUIT BREAKERS, etc.—**Ontario**—See "Power Plants."

CAST IRON PIPE, etc.—**Toronto, Ont.**—W. J. Stewart, mayor, City Hall, 36 in. c.i. pipe, to National Iron Corp., foot of Cherry St., at $150.56 per length; soot blowers, John St., to General Eng. Co., Confederation Life Bldg., $5,600; carbon dioxide recorder, to Brown Instrument Co., 389 St. Paul St. W., Montreal Que., $970; air compressor on 14 ton chassis, to W. C. Warburton & Co., 670 Bloor St. W., $2,706; venturi meter, to E. H. Wilkes Co., 18 Toronto St., $1,370. Noted Oct. 29.

EQUIPMENT

PROPOSED WORK

ROAD MACHINERY—**Oroville, Calif.**—Bd. Supervs., Butte Co., purchasing 60-caterpillar tractor, 12 ft. road grader, rock spreader.

BOILER EQUIPMENT, etc.—**Lebanon, O.**—Village, R. Carey, mayor, preparing plans installing new boiler equipment, with retort stokers and turbine driven fans, 16 ft. addition, West side of present plant; new stack, 5 ft. diam., 160 ft. high, brick, tile or concrete construction, at municipal light plant. W. C. Carson, supt. plant, $24,000.

BIDS ASKED

GENERATING UNITS, etc.—**Spring Valley, Minn.**—Dec. 15, by Village Council, K. Osterud, village clk., 3 Diesel generating units, constructing power house.

AUTO TAG STEEL BLANKS—**Trenton, N. J.**—Dec. 21, E. J. Quigley, by state purch. agt., State Office Bldg., auto tag steel blanks. To exceed $50,000. Noted Dec. 3.

PAVING BREAKERS, etc.—**New York, N. Y.**—Dec. 16, by H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., 2 paving breakers, 1 portable air compressor.

VALUE OF CONSTRUCTION PROJECTS DELAYED AND THE REASONS

(Thousands of dollars, 000 omitted)

	Plans Held up	Bonds not Voted or Sold	Bonds Defeated	No Appropriation	Not Authorized by Taxpayers	Site not Selected	Litigation	Indefinite	Postponed	Total
Alabama										40
Arizona		2,568		713						3,281
Arkansas		20			35			400		455
California		(1) 12,073	475	(2) 3,197	895			2,130	188	18,958
(1) Water-works: San Jose 3,500; San Diego 4,290. (2) Dam El Capitan, 3,000.										
Colorado									165	165
Connecticut				(1) 5,600	115					5,715
(1) State bridge, Hartford, 5,000.										
Florida			(1) 6,500							6,500
(1) Bridge over St. John's River, 6,500.										
Georgia						75				75
Illinois	165	(1) 4,208			475		(2) 4,700	611	800	10,959
(1) Bittendorf-Moline bridge, 1,750. (2) Chicago subway, 4,000										
Indiana	45			150		350	650		(1) 1,415	2,610
(1) Indianapolis Hospital, 1,000.										
Iowa		86	25				400		70	581
Kansas				25					150	175
Kentucky				460			2,500			2,960
Massachusetts	180	450	150	(1) 3,495		375		200	550	5,400
(1) Pittsfield reservoir, 1,500.										
Michigan	250	450	28	(1) 3,150						3,878
(1) City hall, Detroit, 3,000.										
Minnesota		160		2,150		965			120	3,395
Missouri	1,150	(1) 14,420	200	1,000					(2) 4,000	20,770
(1) Museum, St. Louis, 2,500. (2) Central Sewer District, 4,000.										
Nebraska									150	150
Nevada		150			1,200					1,350
New Hampshire						1,200				1,200
(1) Toll bridge over Great Bay, Durham, 1,200.										
New Jersey	375	(1) 8,590		537		150	200		25	9,877
(1) Two buildings, medical center Jersey City, 5,000.										
New York	300	2,720		(1) 292,000			500	150	400	295,870
New York City—(1) Vehicular tunnel, Manhattan-Brooklyn, 50,000; replacing Tombs prison, 10,000; public libraries, 7,000; police headquarters, 5,000; Delaware River watershed, N. Y. C. Bd. Water Supply.										
North Carolina		100						50		150
North Dakota			190	52				180		422
Mississippi									70	70
Montana							(1) 3,000			3,000
(1) Supreme court decided 3,000 bond issue illegal.										
Ohio			280	(1) 1,519			250			2,049
(1) Trunk and relief sewers 30- to 57-in. 1,182.										
Oklahoma		350		100						450
Oregon	(1) 2,500									2,500
(1) Tualitan Valley tunnel, 2,500.										
Pennsylvania		390		765						1,155
Tennessee				100						100
Texas		1,500	450	1,625		200	90	25	150	4,040
Virginia									280	280
Washington							500	100	(1) 8,250	8,850
(1) Bridge over Narrows, Tacoma, 8,000.										
Wisconsin	420			50	60					530
Total	5,425	48,235	8,298	316,688	2,780	3,315	12,590	3,846	16,783	417,960

Constr. News page 213

Equipment (Continued)

STEEL WHEELS and CEMENT—**Phila., Pa.**—Dec. 15, by C. E. Walsh, purch. agt. Pennsylvania R.R. Co., 15 North 32nd St., Contr. 32-1931, steel wheels: Contr. 33-1931, cement.

MOTOR SNOW PLOUGH—**LaSalle, Que.**—City in market 1 motor snow plough.

CONTRACTS AWARDED

PLATES, SPIKES, etc.—**Colorado and Oklahoma**—Atchison, Topeka & Santa Fe R.R. Co., c/o W. W. Kelly, ch. engr. (western lines), Amarillo, Tex., 7,500 tons tie plates, spikes, other rail fastenings to be delivered early in 1932 for use on Las Animas Colo.-Boise, Okla., branch, to Colorado Fuel & Iron Co., Pueblo.

PUMPS—**Quincy, Mass.**—Commonwealth of Massachusetts, Dist. Comm., 20 Somerset St., Boston, 2 pumping units, Squantum Pumping Station, to Turbine Equipment Co. of New England, 80 Federal St., Boston. $7,775. Noted Nov. 19.

TRANSFORMERS, etc.—**Phila., Pa.**—Pennsylvania R.R. Co., Broad St. Sta., T. J. Skillman, ch. engr., 4,500,000 lb. transformers and switch gear equipment for electrification project, to Allis Chalmers Co., West Allis, Wis. Est. $1,000,000.

FOREIGN

England—Remington Typewriters, Ltd., subsidiary Remington Rand, Inc., Tonawanda, N. Y., manufacturing plant. Location not disclosed.

Mexico, Monterrey—Monterrey Hotel Co., c/o W. D. McCallister, archt., Commonwealth Bldg., San Diego, Calif., and Monterrey, plans 1 and 2 story hotel, casino, stores. $200,000. L. D. Royer, Smith-Young Tower Bldg., San Antonio, engr.

New Zealand, Wellington—Apr. 5, by Dept. P. Wks., Secretary P. Wks. Tenders Com., 2 distribution switchboards, 2 panel switchboards, 2 alarm panels and accessories, for Waitak Power Plant.

U.S.S.R., Moscow—Soviet Russia, c/o Amtorg Trading Corp., 261 5th Ave., New York, 46 mi. subway, incl. 5 trunk lines radiating from center of city, by technical aid contracts, 3 year program. $17,000,000 will be spent 1st year (1932). $450,000,000 total.

U.S.S.R., Samara—Soviet Government, c/o Amtorg Trading Co., 261 5th Ave., New York, carburetor and motor plant by technical aid contracts. $12,000,000. Preliminary ground work in progress.

Commercial Buildings

RESIDENTIAL

BIDS ASKED

La., Baton Rouge—S. J. Britton & associates plans by Favrot & Livaudais, Mola Bldg., New Orleans, and takes bids within 90 days general contract 14 story, basement, face brick, stone hotel, incl. garage in basement, also shops, restaurant, radio in each room, roof garden, North and 3rd Sts. $650,000.

N. J., Springfield—J. B. Betty, archt., 15 North Reid St., Elizabeth, soon takes bids general contract 2 story, basement, brick, steel store, apartment, 272-74 Morris Ave., for M. Dandrea, Springfield. $150,000. Former bids rejected. Noted Nov. 12, under "Contracts Awarded."

N. J., West Orange—Washington Arms, Inc., 116 Market St., Newark, bids about Feb. 1, general contract 5 story, basement, 90 x 115 ft., brick, steel, Washington St. $150,000. Former bids rejected. N. Harris, 17 Mechanic St., Newark, archt. Noted Oct. 15.

N. Y., New York—Owner, c/o L. F. Knuest, archt., 369 Lexington Ave., taking bids separate contracts apartment, 135 East 39th St. $350,000.

N. Y., Queens Village—See "Contracts Awarded."

N. Y., St. Albans—See "Contracts Awarded."

N. Y., St. George—See "Contracts Awarded."

Ont., Toronto—See "Contracts Awarded."

CONTRACTS AWARDED

Md., Baltimore — Charles and Thirty-Third Streets Apartments, c/o F. A. Fletcher, 517 North Charles St., archt., 10 story apartment, to Gunn, Williamson & Guy, Morris Bldg., $500,000.

Md., Baltimore—Northway Apartments, 3700 North Charles St., corner Bishop Rd., c/o Palmer & Lamdin, 513 North Charles St., archts., apartments, to Abell Building Co., Calvert Bldg., $1,500,000.

N. Y., Queens Village—Woodboro Realty Corp., 4302 63rd St., 6 story, 109 x 119 ft. apartment, 61st St. and Polk Ave., separate contracts, $225,000. W. Hohauser, 17 West 44th St., New York, archt.

N. Y., St. Albans—St. Albans Homes, Inc., 153 Pierrepont St., Brooklyn, apartment, 223rd St., and 116th Ave., separate contracts, $150,000. C. Cannella, 1163 Herkimer St., Brooklyn, archt.

N. Y., St. George—St. George Tower Corp., J. Black, pres., 29 Sherman Ave., Tompkinsville, 6 story, basement, 60 x 115 ft., brick, steel, Monroe Ave., separate contracts, $200,000. M. G. Uslan, 37 Bay St., archt.

Constr. News page 214

N. Y., West New Brighton—Einziger Bros., Inc., 21 Herberton Ave., Port Richmond, general contract 4 story, basement, brick, steel, Forest Ave. and Havenwood Rd., to Block & Lubin, 46 Oxford Pl., St. George. Est. $150,000.

Wis., Tomahawk—Tomahawk Hotel Co., F. Thielei, general contract 5 story, rein.-con., steel hotel, to T. S. Wellis, 326 Hayes Bldg., Janesville. Est. $150,000.

Ont., Toronto—H. H. Roberts, 483 Parkside Dr., 3 story, basement, fireproof, 42 Isabella St., masonry contract, to W. Jameson, 131 Perth Ave.; plumbing, to T. H. Denison, 126 Essex St. Est. $150,000. Carpentry, excavation, etc. by owner, day labor.

CLUBS

PROPOSED WORK

Mass., Hyde Park—City of Boston, Park Dpt., 33 Beacon St., Boston, sketches by J. G. McGann, 129 Newbury St., Boston, club house at Municipal golf course. $150,000.

Mich., Detroit—Y.W.C.A., Adams, and Witherell Sts., soon lets contract 4 story negro branch Y.W.C.A. $150,000.

N. J., Asbury Park—Monmouth Lodge 122, Pride of Asbury Temple, 64 I. B. P. O. E. of World, plans by W. F. Kesselmina, 9th Ave., Belmar, 2 story, basement, 50 x 110 ft., brick, steel club house. $150,000. Noted Nov. 26.

N. J., Asbury Park—Y. W. H. A., W. S. Klausner, pres., 730 Cookman Ave., new sketches 1 story, basement, brick, steel community center and gymnasium. $150,000. Noted Aug. 19.

N. J., Hohokus—P. J. Jossier, archt., 240 Broad Ave., Palisades Park, soon takes bids on revised plans 2 story, basement, brick, steel, stucco golf club, for Owner, c/o architect. $150,000. Noted Sept. 17.

BIDS ASKED

N. J., Jersey City—C. I. Goldberg, archt., 921 Bergen Ave., bids about Mar. 1, general contract 2 story, basement, brick, steel club house, Fleet St., for Ukranian Home of Jersey City, Inc., 77 Morris St., $150,000. Noted Nov. 26.

N. J., Jersey City—Kelly & Cowan, archts., 921 Bergen Ave., bids about Mar. 1, general contract 3 story, basement, brick, steel club house, for Knights of Columbus, T. J. Norton, 441 Jersey Ave. $150,000.

N. J., Paterson—Goodman & Schulman, archts., 20 Smith St., general contract, bids about Feb. 1 on revised plans, 2 story, basement, brick, steel club, Carroll St. and 12th Ave., for Workmen's Circle Labor Lyceum Corp., $150,000. Noted Dec. 3.

CONTRACTS AWARDED

Mass., Marblehead—Tedesco Country Club, rebuilding 3 story, basement, brick country club, recently destroyed by fire, to C. S. Cunningham & Sons Constr. Co., Statler Bldg., Boston. Est. $150,000 or more.

HOSPITALS

PROPOSED WORK

N. J., Hasbrouck Heights—Hasbrouck Heights Hospital, H. K. Cohan, supt., 272 Columbus Ave., revised sketches by J. D. Lugosch, 714 Bergenline Ave., Union City, 3 story, basement, brick, steel, Columbus Ave. $175,000. Noted May 21.

N. J., Newark—J. H. and W. C. Ely, archts., 15 Washington St., rejected bids altering and constructing 4 story, basement, brick, steel hospital addition, for Newark Eye & Ear Infirmary, 77 Central Ave. $150,000. Noted Sept. 24.

N. Y., New York—B. H. Whinston, archt., 6 East 46th St., bids about January on revised plans 2 story, 84 x 92 ft. hospital, 166th St. and Grand Concorse, for Bronz Maternity Hospital. Noted Oct. 8.

N. Y., New York—Dpt. Hospitals, Municipal Bldg., soon takes bids general contract outpatient building, for Harlem Hospital. $1,400,000.

BIDS ASKED

Ill., Manteno—Dec. 15, by State of Illinois Dpt. Purchase & Constr., Capitol Bldg., Springfield. 70 x 336 ft. hospital, incl. wards, operating rooms, autopsy and dining rooms, $150,000. E. H. Clark, 8 East Huron St., Chicago, assoc. archt., also 271 x 335 ft. diagnostic hospital, incl. neurology, X-Ray, dental, physiotherapy, laboratory, library, $500,000. Granger & Bollenbacher, 333 North Michigan Ave., Chicago, assoc. archts., both buildings, 2 story, basement, rein.-con., brick, plain founds. State Div. Architects & Engineers, Capitol Bldg., Springfield, archts. L. A. Snider Engr. Serv., 605 North Michigan Ave., Chicago, engrs. Noted Oct. 29.

Mass., Norfolk—Dec. 22, by Commonwealth of Massachusetts, Dpt. Correction, State House, Boston, brick farm dormitory, at State Prison Colony, $150,000 or more. Monks & Johnson, 99 Chauncy St., Boston, archts. Noted Oct. 8.

N. Y., Pine Aire Station—Dec. 16 (extended date), by Dpt. Mental Hygiene, State Office Bldg., Albany, farm buildings at Pilgrim State Hospital; adv. E. N.-R. Dec. 10. Noted Nov. 26.

Wis., Wauwatosa—Dec. 14 (extended date), by W. L. Coffey, mgr., Milwaukee Co., 4 story, basement, 160 x 180 ft. nurses' home, $300,000. Van Ryn & DeGelleke, 114 Wisconsin Ave., Milwaukee, archts. Noted Nov. 26.

CONTRACTS AWARDED

Mass., Peabody—City, J. P. Thomas Hospital, King St., altering and constructing 3 story, basement, brick, steel hospital addition, plain found., to E. H. Porter Constr. Co., 13 Wallis St. Est. $150,000. Noted Oct. 29.

Mich., Ionia—G. R. Thompson, budget c/ State Administrative Bd., Lansing, general c tract 4 story, basement, rein.-con., brick, st hospital, plain found., to Patterson Constr. C 2631 Woodward Ave., Detroit, $190,510; stea heating, to Vauder Waals Troske Co., Gra Rapids, $19,527. Noted Sept. 17.

N. Y., Creedmoor—Commissioner Dpt. Men Hygiene, State Office Bldg., Albany, general c tract Bulidings 12, 19, 20, 21 and 22, Bro lyn State Hospital, Creedmoor Div., to Agosti Bros., 205 East 42nd St., New York, $496,80 heating, to J. M. Kandel, 992 2nd Ave., N York, $37,650; sanitary work, to Weber Hamilton, 25-21 23rd St., Long Island Ci $39,447; electrical work, to Erickson Equi ment Co., 452 Lexington Ave., New York, $2 400. Grand total $596,303. Noted Oct. 2

Pa., Allentown—Dpt. Properties & Supplie State of Pennsylvania, Harrisburg (1st unit story, basement, 37 x 92 ft., rein.-con., bric timber attendants house, to Ritter Bros., 80 South 17th St., Harrisburg, $83,600

CHURCHES

PROPOSED WORK

Mass., Brockton—Greek Orthodox Church, c/ C. T. Olson, archt., 101 Main St., sketches story, basement church. $150,000 or mor funds being raised for same.

N. J., Montclair—Episcopal Diocese o Newark, J. Fetcher, chn. Building Com., 44 Upper Montclair Ave., cathedral, Watchun Mountain, east side Cedar Grove Reservoir $1,000,000. **Maturity soon.** Architect not ap pointed.

N. J., Plainfield—First Presbyterian Church L. W. Warren, pastor, 41 Sanford Ave sketches and takes bids about February, alter ing and constructing 2 story, basement, brick steel addition, East Front St. $150,000. Pri vate plans. G. R. Hinman, 718 Kensington Ave., in charge of design. Noted Nov. 26

Wis., Waupaca—St. Mary Magdalene Con gregation, A. O. Rielander, pastor, plans t Foeller & Schoeber, Green Bay, church $150,000. Noted Oct. 22.

CONTRACTS AWARDED

N. J., Morristown—Fanning & Shaw, archts 49 Ward St., Paterson, general contract 2 story basement, 80 x 145 ft., brick, steel, church parochial school, to Bontempo & D'Annunzio, 3 Washington St., for St. Margaret's Roman Catholic Church, J. J. Sheean, pastor, 63 Earl St. Est. $150,000. Noted Nov. 19.

SCHOOLS

PROPOSED WORK

Conn., Wethersfield—Town, W. Greer, supt schools, 2 school additions, Griswold St. and 1 at Church Pl. $150,000 or more. Architect not appointed.

Mass., Taunton—Sacred Heart Roman Catholic Church, E. J. Moriarty, 29 1st St., sketches by H. Fallows, 131 Stewart St., Fall River, 2 story, basement, brick school, 2nd St. $150,000. Noted Sept. 3.

Mo., St. Louis—Bd. Educ., 911 Locust St., bids early in 1932, 3 story, basement, 400 x 509 ft., rein.-con., brick, stone high school, incl. 2 gymnasiums, auditorium, South Kingshighway and Arsenal St. $900,000. E. T. Friton, c/o owner, engr. and archt. Noted Aug. 12.

N. H., Hooksett—Mt. St. Mary's Academy, Sister M. de La Salle, plans by Maginnis & Walsh, Statler Bldg., Boston, Mass., altering and constructing 1 and 2 story, basement, brick, stone chapel, auditorium additions, $150,000 or more.

N. J., Englewood—Woodrow Wilson University, P. Nemhoff, 655 Bergenline Ave., West New York, 2 story, basement, brick, steel college, Allison Estate. $150,000. **Maturity soon.** Architect not appointed.

N. J., Fair Lawn—Bd. Educ., Boro Hall, sketches 2 story, basement, brick, steel addition, Henderson Terrace, $150,000. Noted Sept. 24.

N. J., Little Silver—Bd. Educ. revised sketches by E. A. Arend, Kinsmouth Bldg., Asbury Park, and takes bids in February general contract 2 story, basement, brick, steel, Markham Rd. $150,000. Noted Nov. 26.

N. J., Lyndhurst—Bd. Educ., High School, 2 story, basement, brick, steel school. $150,000. **Maturity indefinite.** Architect not appointed.

N. J., North Plainfield—Bd. Educ., 125 Somerset St., plans by J. N. Pierson & Son, Smith St., Perth Amboy, 2 story, basement, brick, steel, Harrington Pl. $150,000. **Maturity indefinite.** Noted Nov. 26.

N. J., Ramsey—Bd. Educ., J. Y. Dates, pres., High School, plans by A. E. Sleight, Romaine Bldg., Paterson, 2 story, basement, brick, steel high school. $400,000. **Maturity indefinite.**

N. J., Teaneck—Bd. Educ., High School, bids late in January, 3 story, basement, 100 x 226 ft., rein.-con., brick, steel, high school addition, Queen Anne Rd. and Elizabeth Ave. $635,000. Hacker & Hacker, 201 Main St., Fort Lee, archts. O. E. Goldsmith, 110 West 40th St., New York, engr. Noted Oct. 8.

N. J., Teaneck—St. Anastasias Roman Catholic Church, Robinson St., sketches by DePace & Juster, 151 West 45th St., New York, 2 story, basement, 100 x 125 ft., brick, steel school, auditorium, Teaneck Rd. and Robinson St. $150,000.

N. Y., Brooklyn—Christian Bros., c/o T. E. Malloy, bishop, 367 Clermont Ave., bids after Dec. 15, general contract parochial school,

Schools (Continued)

Greene, Claremont, Lafayette and Vanderbilt Aves. $400,000. Noted Aug. 19.

N. Y., Flushing—Bd. Educ., 500 Park Ave., New York, plans by W. C. Martin, Flatbush Ave. extension and Concord St., Brooklyn, P.S. 163. $304,000.

N. Y., Garden City—Bd. Educ., bids probably in January, school. To exceed $250,000. Starrett & Van Vleck, 393 7th Ave., New York, archts. Project contingent upon sale of school bonds.

N. Y., Jackson Heights—Church of Blessed Sacrament, T. E. Malloy, 367 Clermont Ave., Brooklyn, soon takes bids general contract parochial school, Fillmore Ave. and 94th St. $150,000. H. McGill, 415 Lexington Ave., New York, archt. Noted Nov. 5.

N. Y., Long Beach—Bd. Educ. plans by Smith & Ward, 100 East 42nd St., New York, school. $200,000.

Pa., Oil City—Bd. Educ., E. W. Egan, secy., Beach Bldg., plans by W. H. Crosby, 31 Beers Bldg., Senior High School, brick, steel, on campus, $227,000; plans by Brenot & Brown, Traymore Bldg., brick school, south side, 10th Ward, $75,000. Noted Sept. 24.

Pa., Pittsburgh—Bd. Educ., H. W. Cramblet, secy., Administration Bldg., sketches by Marks & Kahn, Home Trust Bldg., Alice M. Carmalt Elementary School, Fairhaven Blvd. and East Brookline Rd. $200,000.

Pa., Scranton—Nativity Parish, Scranton Diocese, sketches parochial school. $300,000. J. R. McCormick, Scranton, engr., Scranton Diocese.

R. I., Providence—Moses Brown School, L. Rahlston, Thomas, master, sketches by Morris & Erskine, 1716 Cherry St., Phila., Pa., preparatory school unit addition, Hope St. $150,000 or more.

Tex., College Station—A. & M. College (State), plans by F. E. Giesecke, (college archt.), College Station, brick, rein.-con. administration building, $150,000; 1 to 3 story, animal industry building $250,000, and 2 to 3 story, veterinary hospital $250,000, both brick, rein.-con. stone, all to have plain founds. Private plans.

Ont., Belleville—Ontario Government, G. Hogarth, deputy minister Dpt. P. Wks., Ottawa, sketches 3 new units to house 200 pupils at School of Deaf. $300,000.

Ont., Ottawa—Ottawa Separate School Bd., H. Desormeaux, secy., Murray Pl., sketches 16 room school. **Maturity early in 1932.**

BIDS ASKED

Mass., Wellesley—Dec. 14, by Wellesley College, c/o W. T. Aldrich, archt., 30 Newbury St., Boston, 4 story, basement, brick, irregular sized, co-operative dormitory, plain found. $150,000 or more. Noted Nov. 12.

Minn., Minneapolis—Dec. 8, by Stebbins, Haxby & Bissell, and C. F. Leighton, assoc. archts., 1111 Nicolet Ave., 2 story, basement, brick, stone, rein.-con. school, dormitory, 18th Ave. and South 24th St., for Church of Holy Rosary, 2424 18th Ave. S. $150,000. Noted June 4.

N. J., Livingston — Bd. Educ., Township Hall, bids Feb. 1, general contract 2 story, basement, brick, steel addition to Roosevelt School. $150,000. Guilbert & Betelle, 20 Branford Pl., Newark, archts. Noted Nov. 26.

N. J., Madison—Bd. Educ., G. F. Sutherland, pres., High School, bids about Jan. 15, 2 story, basement, brick, steel high school addition, Main St. $150,000. Guilbert & Betelle, 20 Branford Pl. Newark, archts. Noted Nov. 19.

N. J., Millburn—Bd. Educ., High School, bids about Jan. 15, 2 story, basement, brick, steel school, $200,000. E. Sibley and G. M. Cady, 1034 Edgewood Lane, Palisade, archts. Noted Oct. 1.

N. Y., Corona—Dec. 17, by W. C. Martin, archt. and supt. School Buildings, Flatbush Ave. extension and Concord St., Brooklyn, general contract addition to P. S. 16, 104th St. between 41st and 42nd Aves., for Bd. Educ., 500 Park Ave., New York. Noted Nov. 19.

Ont., Hamilton—Dec. 15, by R. H. Proctor, bus. administrator Bd. Educ., City Hall, 3 story, basement, concrete, brick, stone, steel commercial school, Sanford Ave. $300,000. B. H. and F. Prack, 36 James St. S., archts. Noted Nov. 12.

Ont., Toronto—Mathers & Haldenby, archts., 96 Bloor St. W., taking bids 4 story, concrete, brick, steel, stone, marble, tile hygiene building, on campus, for Toronto University of Toronto, Queens Park. $300,000. Noted Oct. 29.

Ont., Toronto—Dec. 14, by Bd. Educ., 155 College St., 3 story, basement, concrete, stone, structural steel addition to Oakwood Collegiate Institute, incl. lathing, plumbing, heating, ventilating, etc., $150,000. C. Dyson, 155 College St., archt. Noted Sept. 24.

CONTRACTS AWARDED

Colo., Colorado Springs—Trustees Colorado College, c/o C. C. Mierow, pres., general contract 2 story, basement, stone library addition known at Coburn Library, on campus, to Platt Rogers, Inc., Pueblo. Est. $250,000. Mrs. F. M. P. Taylor, Colorado Springs, finances and donates the addition. Noted Nov. 19.

Mass., Roslindale (sta. Boston)—City of Boston, Dpt. School Buildings, 2 story, basement, brick, stone, plain found., Beech St., to M. Cummings Co., 43 Tremont St., Boston. Est. $150,000. Noted Nov. 19.

Mo., Kansas City—Bd. Educ., G. C. Tinker, secy., general contract 4 story, basement, 152 x 225 ft., rein.-con., brick, stone, addition to East High School, to Inter-State Constr. Co., Walsix Bldg., $283,430; heating and ventilating, to Interstate Heating & Plumbing Co., 521 Southwest Blvd., $27,985; plumbing and drainage, to G. R. Jorgensen, 3313 East 15th St., $16,600; lighting fixtures, to Benson Brass & Chandelier Wks., 1417 Agnes St., $1,869. Grand total $329,884. Noted Nov. 12.

Pa., Pittsburgh—Bd. Educ., H. W. Cramblet, secy., Administration Bldg., general contract Westinghouse High School, brick, steel, to Navarro Co., 6219 Broad St., $271,500; heating and ventilating, to Bartley O'Neill Co., 240 Boulevard of Allies, $47,750; unit heaters, to B. F. Sturtevant Co., Park Bldg., $7,350; plumbing, to Snively Plumbing & Heating Co., 1138 North Euclid Ave., $28,543; electrical work, to Best Light Co., 3312 Niagara St., $14,450. Grand total $369,593. Noted Nov. 12.

THEATRES

PROPOSED WORK

Ga., Atlanta—J. A. Ress, 516 Boulevard S. E., plans by Marye, Vinour, Marye & Armistead, Walton Bldg., 2 story, 50 x 102 ft., brick, structural steel, stone theatre, concrete found., Fair St. S. E.

BIDS ASKED

N. J., Newark—F. Grad, archt., 1023 Broad St., taking bids general contract altering and constructing 4 story, basement addition to theatre and store, Market and Ward Sts., for Fleissner Realty Co., c/o architect. $150,000.

N. J., Red Bank—Boylan & Levine, archts., 143 Albany St., New Brunswick, bids about Feb. 1, general contract 2 story, basement, brick, steel theatre, for Red Bank Amusement Co., c/o architects. $250,000. R. C. Burke, 76 Summit Ave., Plainfield, engr. Noted Oct. 1.

BANKS

CONTRACTS AWARDED

N. J., Newark—Marzano State Bank & Trust Co., 15 Ferry St., general contract altering and constructing 2 story, basement, 25 x 100 ft., brick, steel bank addition, to Fatzler Co., 11 Hill St. Est. $150,000. Noted Nov. 12.

N. Y., Brooklyn—Brooklyn Trust Co., 177 Montague St., 3 story, basement, 55 x 72 ft. bank, Bedford Ave. and Fulton St., to R. Von Lehm & Son, 2701 Glenwood Rd.

OFFICES

PROPOSED WORK

Mass., Quincy—Standard Oil Co. of New York, Park Sq. Bldg., Boston, bids in January, office, garage, docks, tanks between Town River and Washington St. $1,000,000. Private plans. Noted Oct. 22 under "Garages."

N. J., Englewood—R. Livingston, 13 East Palisade Ave., sketches 5 story, basement, brick, steel office, store, Palisade Ave. and North Dean St. $150,000. Private plans. Noted Oct. 22.

N. J., Hackensack—H. C. Harper and F. W. Bogert, 37 Huyler St., 2 story, basement, brick, steel office, State St. $150,000. Architect not appointed. **Maturity indefinite.**

N. Y., New York—Railway Express Agency, 219 East 42nd St. sketches 2 story express office, distribution, 420 East 34th St. $63,000. Private plans.

Okla., Oklahoma City—E. A. Walker, Tradesmens Bank Bldg., sketches 10 story, 25 x 140 ft. addition, Main St. $175,000. Architect not appointed.

BIDS ASKED

N. J., Newark—Owner, c/o J. B. Acocella, archt., 9 Clinton St., bids about Feb. 15, general contract 2 story, basement, brick, steel office, store, Bergen St. $150,000. Noted Sept. 17.

N. J., Union—F. A. Elsasser, archt., 1000 Stuyvesant Ave., taking bids general contract 2 story, basement, brick, steel post office, store, office, Morris Ave., for Aryan Holding Corp., 998 Stuyvesant Ave. $150,000. Treas. Dept., Wash., D. C., lessee for post office. Noted Nov. 26.

CONTRACTS AWARDED

N. Y., New York—Insurance Company of North America, 111 John St., 25 story office, to A. L. Hartridge & Co., Inc., 570 Lexington Ave. Est. $2,500,000. Noted June 11.

STORES

PROPOSED WORK

Mass., New Bedford—M. A. Davis, 140 Highland St., Brockton, sketches by L. S. La Brode, Olympia Bldg., 3 story, basement, 105 x 150 ft. brick, limestone store, bowling alleys and hall, plain found., Acushnet Ave. and Union St. $250,000.

Wis., Milwaukee— T. A. Chapman Department Store, 125 East Wisconsin Ave., bids in spring or later, general contract department store. To exceed $150,000. Starrett & Van Vleck, 393 7th Ave., New York, archts.

BIDS ASKED

Mass., Marlboro—See "Contracts Awarded."

N. J., Hackensack — Warren & Warren, archts., 31 Clinton St., Newark, taking bids general contract 2 story, basement, brick, steel store office, 258-62 Main St., for Bergen Union Corp., c/o architects. $150,000.

CONTRACTS AWARDED

Mass., Boston—Park Square Corp., 3 Park St., Boston, reconstructing and altering 5 story, basement, brick, steel store, office, Stuart St., to L. K. Porter Co., 156 Stuart St. Est. $150,000.

Mass., Marlboro—A. T. Nelson, 1 Federal St., Boston, altering and constructing 4 story, basement, brick store, office, plain found., 192 x 201 Main St., separate contracts. $150,000. Private plans.

N. Y., New York — Corporation, c/o I. Robinson, 3527 Jerome Ave., 6 story, 79 x 112 ft. store, apartment, Taylor Ave. and 177th St., to Weeks Avenue Constr. Co., 3527 Jerome Ave. Est. exceeds $150,000. Noted Nov. 26.

O., Cleveland—Winton Hotel Co., c/o F. B. Taylor, mgr., 1012 Prospect Ave., altering hotel incl. new store fronts on 1st floor, changing rooms, heating, plumbing, redecorating, refurnishing, to Lundoff-Bicknell Co., B. F. Keith Bldg. Est. $400,000.

LOFTS

PROPOSED WORK

N. Y., Brooklyn—Magnum Holding Corp., c/o Shampan & Shampan, archts., 188 Montague St., sketches 6 story, basement loft, 73rd St and Flushing Ave. $300,000.

PUBLIC

PROPOSED WORK

Calif., Los Angeles—OBSERVATORY and HALL of SCIENCE—City of Los Angeles Park Dpt. plans by Austin & Ashley, 608 Chamber of Commerce Bldg., 2 story, steel, masonry, incl. several halls, one with stage, work rooms, planetarium, library, gallery, observatory, administrative offices, Griffith Park. $750,000. Noted Aug. 6.

Mass., Boston—POLICE STATION, etc.—City Dpt. P. Buildings, plans by J. M. Gray & J. P. Heffernan, 175 High St., and soon takes bids 2 story, basement, brick, stone police station and tunnel administration building, Richmond and North Sts. $250,000. Noted Apr. 9.

N. J., Wayne—MUSEUM—Passaic Co. Park Comrs., 45 Church St., Paterson, restoring and altering Dey House, 2 story, basement, Preakness Sect. $150,000. Architect not appointed. Maturity soon.

Wis., Sheboygan—COURT HOUSE—Sheboygan Co., H. W. Timmis, clk., rein.-con., brick, steel, $700,000. Architect not appointed.

Que., Montreal — PROVINCIAL OFFICE — Provincial Dpt. P. Wks., Quebec City, 4 story, stone, rein.-con., Notre Dame St. E. $1,000,000. Private plans.

BIDS ASKED

Mass., Wrentham—INFIRMARY—Dec. 18, by Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, brick infirmary unit at State Hospital. $150,000. C. B. Hoyt, 8 Beacon St., Boston, archt. A. B. Franklin, 25 Haverhill St., Boston, engr. Noted Oct. 1.

N. Y., Industry—SERVICE COTTAGE—Dec. 17, by Superintendent Div. Standards & Purchase, State Office Bldg., Albany, enlarging equipping service cottage, State Agriculture and Industrial School; arch. E. N. R. Dec. 10.

N. Y., Mount Kisco—FIRE HOUSE, etc.—Dec. 18, by Village, fire house and municipal building, Main St. $150,000. J. W. Schmidt, 1440 Bway., New York, archt. Noted June 18.

CONTRACTS AWARDED

Mass., Belmont — DORMITORY — Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, 3 story, basement employees dormitory, brick, stone, plain found., at State School, to F. Losordo, 24 School St., Boston, $139,000. Noted Nov. 12.

Minn., St. Paul—OFFICE—State Building Comm., H. Rines, secy., 308 State Capitol, 6 story, basement, 161 x 228 ft., brick, steel, granite facing, to W. W. Magee, Commercial State Bank Bldg., $1,000,000. Noted Oct. 29.

N. J., Rahway—ATTENDENTS—Dpt. Institutions & Agencies, State Office Bldg., Trenton, general contract 3 story, basement, brick, steel, at New Jersey Reformatory, to A. Christensen, 80 Broad St., Elizabeth, plumbing, to Ruehl & Hatfield, Inc., 384 South 10th St., Newark; heating and ventilating, to G. J. Tobin, 187 North Ave., Plainfield; electrical work, to C. N. Taylor, 15 East Elizabeth Ave., Linden; steel and iron, to Jersey Steel Co., Trenton Trust Bldg., Trenton. Est. $150,000.

Tex., Big Springs—CITY HALL and FIRE STATION—City, c/o M. Stewart, secy., general contract 2 story, 127 x 330 ft., brick, stone, steel, rein.-con., to C. S. Lambie Constr. Co., Amarillo, $139,000; plumbing, to A. P. Kasch, Big Springs; electric wiring, to D and R Electric Co., Big Springs; jail equipment, to Paul Jail Building Co., Dallas. Est. $200,000. Noted Nov. 12.

UNCLASSIFIED

PROPOSED WORK

D. C., Wash.—EMBASSY—French Government, Paris, France, plans by P. P. Cret, Architect Bldg., Phila., Pa., embassy, 16th St. $1,000,000. **Maturity indefinite.** Noted July 11, 1929.

Ill., East St. Louis—STATION — Terminal R.R. Assn. of St. Louis, H. Miller, pres., 1800 Market St., St. Louis, Mo., bids in spring 3 story, basement, rein.-con., brick, stone, Main St. $700,000. H. J. Pfeiffer, c/o owner, ch. engr. Noted Nov. 6.

Mass., Boston—MEMORIAL—Commonwealth of Massachusetts, Memorial Comn., State House, sketches by G. A. Johnson, 16 Norwich St., Worcester, granite war memorial building, Back Bay Fens at Boylston St. and Richardson Bridge. $1,000,000. Noted Oct. 1.

Constr. News page 215

Unclassified (Continued)

N. Y., Saratoga Springs — DORMITORY — Owner, c/o Ludlow & Peabody, archts., 101 Park Ave., New York, soon lets contract dormitory, $150,000. Bids in.

Tenn., Memphis—COMMERCIAL—B. Goodman, Bank of Commerce Bldg., soon takes bids 4 story, concrete, brick, 60-62 South Main St. $200,000. E. Harrison, Fidelity Bank Bldg., archt. Palmer Clothing Co., 108 South Main St., and Gayoso Trunk & Bag Co., 42 South Main St., lessee.

Ont., Toronto—MARKET—Syndicate, c/o J. L. Cohen, 45 Richmond St. W., plans by Kaplan & Sprachman, 305 Dundas St., West Toronto, 2 or 3 story, basement, 60 x 100 ft. stone, brick market, to accommodate 50 stores and offices, concrete found., Spadina Ave. $160,000.

CONTRACTS AWARDED

Calif., Santa Barbara — H. H. Gutterson, archt., 526 Powell St., San Francisco, rein.-con., steel church, to W. L. Snook, 1835 Mission Bridge, for 1st Church of Christ Scientist. $150,000. Noted Aug. 14.

Pa., Grove City—MAUSOLEUM and CHAPEL —Mercer County Memorial Park, granite, marble, bronze, Sandy Lake Rd., to Amer. Mausoleum & Constr. Co., Clyde, O., $164,000.

Industrial Buildings

FACTORIES AND MILLS

PROPOSED WORK

Calif., Arcata—CANNERY—Stacey Fisher & Chester Paul, c/o J. C. Bull Co., sketches 60 x 100 ft. cannery. $40,000 excluding equipment.

Ill., Hillsboro—GARMENT FACTORY—Hillsboro Chamber of Commerce, C. T. Wheat, pres., and Rice-Stix Dry Goods Co., 1000 Washington St., St. Louis, Mo., sketches by J. Boehmer, c/o Rice-Stix Dry Goods Co., 1000 Washington Ave., St. Louis, Mo., 2 story, basement, 90 x 150 ft., concrete, brick. $50,000.

N. J., Jersey City—PLANT—Gibraltar Electric Clock Co., Inc., J. Gottlieb, pres., 66 Nassau St., New York, altering manufacturing plant and equipment, Bramhall, Woodward and Van Horne Sts. To exceed $40,000 incl. equipment. Architect and engineer not appointed.

N. J., Newark—FACTORY—Owner, c/o R. C. Klemm, archt., 944 Broad St., sketches 2 story, basement, brick, steel, Oxford St. $40,000.

N. Y., Larchmont — LAUNDRY — Knickerbocker Laundries, 41 East 42nd St., New York, laundry. $55,00. **Maturity about February.**

N. Y., New York—LAUNDRY—Consolidated Laundries Corp., 122 East 42nd St., A. S. Jenkens, pres., sketches laundry and garage, 5th Ave. and 141st St. $50,000. P. A. Faribault, 103 Park Ave., engr.

O., Massillon—STRIP MILL—Republic Iron & Steel Corp., 335 Market St., Youngstown, strip mill. $500,000. **Maturity soon.** Private plans.

Pa., Neville Island (Pittsburgh P. O.) — PLANT and WAREHOUSE—Frick Reid Supply Corp., Sandusky and Robinson Sts., Pittsburgh, concrete, steel pipe fabricating plant and pipe warehouse. $50,000. Private plans.

R. I., West Warwick—GAS PLANT—Warwick Gas Co., c/o Johnson Church & Co., 149 Bway., New York, gas plant. $40,000. **Maturity in summer or later.** Noted Nov. 13, 1930.

Texas — CLOTHING FACTORY — Goodall Worsted Co., c/o W. N. Campbell, pres., Sanford, Me., surveys clothing factory. Location not determined.

Tex., Jasper—CRATE and WOOD PRODUCTS PLANT—Evans Products Co., Inc., Union Trust Bldg., Detroit, Mich., 2 unit (ultimately 12 unit) crate and wood products plant. Private plans.

Tex., Tahoka—CHEMICAL PLANT—Continental Chemical Co., Burt Bldg., Dallas, soon takes bids 5 buildings and 5 residences, each 1 story, brick, rein.-con.; 2½ story, evaporating building, 70 ft. high, no roof; also pumping equipment, levee work and 28 mi. railroad to plant. $1,500,000. W. D. Alt, Dallas, engr. and A. G. Shutler, Chicago, Ill., assoc. engr.

Wis., Oshkosh — FACTORY — Gunz-Durber Candy Co., E. A. Surlei, pres., 19 Marion St., rebuilding 2 story, brick, steel, rein.-con. recently destroyed by fire. $40,000. Architect not appointed.

Ont., Hamilton—STORAGE and DISTRIBUTING PLANT—Shell Oil Co. of Canada, Hamilton, soon takes bids (1st unit) 1 m.g. tank, for gasoline and oil storage distributing plant.

BIDS ASKED

Mass., Boston—PLANT—Brighton Dressed Meat Co., 39 Commercial St., taking bids altering 2 story, brick manufacturing plant. $40,000 Worcester Tram Rail Co., Inc., 10, T. Wharf, archts.

Mass., Everett—DYE HOUSE PLANT—Boston Dye House, Inc., 1911 Revere Beach Parkway, taking bids altering and constructing 1 story, brick dye house plant addition, plain found. $40,000. M. Linenthal, 250 Devonshire St., Boston, engr.

Mass., Gardner — FACTORY — Tyson Bros., Woodbridge, N. J., taking bids 2 story, brick, timber, concrete factory. $40,000 or more. Private plans. Noted Dec. 3.

Constr. News page 216

Mass., Woburn—CANNING PLANT—Jan. 1, by Wilmington Packing Co., New Boston St. 2 complete canning units, New Boston St. A. Dinto, c/o owner, engr.

N. Y., Long Island City—LAUNDRY—Knickerbocker Laundries Co., G. Lange, in charge, taking bids general contract laundry. To exceed $40,000. Fenichel Co., 220 East 42nd St., New York, archt. Noted Nov. 5.

N. Y., New York—LAUNDRY—Jan. 2, by Hunts Point Wet Wash Laundry, Garrison and Longfellow Aves., 1 story, 100 x 100 ft. laundry, Garrison and Longfellow Aves. $40,000. Fenichel Co., 220 East 42nd St., archt. Noted Nov. 12.

Pa., Phila. — MANUFACTURING — National Casket Co., 2043 Arch St., bids about Jan. 14, 4 story, basement, irregular shaped, rein.-con., brick, plain found., 1519-21 Fairmount Ave. Private plans.

Pa., Warren—COMPRESSOR UNIT—See "Contracts Awarded."

Tex., San Angelo—ICE CREAM and DAIRY PLANT—Banner Ice Cream Co., c/o O. D. Dillingham, Abilene, bids about Dec. 15, 2 story, brick, rein.-con., plain found., 1,500 gal. milk daily, 500 lb. butter churning capacity, 1,000 gal. ice cream daily, etc. $40,000. Private plans.

CONTRACTS AWARDED

Calif., Los Angeles—FACTORY—Los Angeles Soap Co., 617 East 1st St. (1st unit) 1 story, basement, triangular shaped, extreme dimensions 140 x 268 ft., Class A basement, to Schuck Constr. Co., 1937 West 62nd St., $65,000. Morgan, Wells & Clements, 1135 Van Nuys Bldg., archts. Noted Nov. 5.

Calif., Riverside—PACKING HOUSE—Union Pacific System, Architectural Dpt., Pacific Electric Bldg., Los Angeles, brick plant, to T. C. Pritchard, 5260 Magnolia Ave. Est. $50,000. Noted Nov. 27.

Calif., Upland—PRE-COOLING PLANT—Upland Citrus Assn., cement work for citrus pre-cooling plant and addition, to W. E. Cline, 895 Washington Blvd., machinery, to Carbondale Machine Co., 1031 South Bway., Los Angeles; cork insulation, to Mundet Cork Corp., 401 8th Ave., New York. Est. $65,000. Noted Nov. 19.

Ind., Elkhart—FACTORY—Illinois Carton & Label Co., 2601 North Crawford St., Chicago, Ill., general contract 1 story, 130 x 200 ft. brick, steel, to G. Kistner & Son, 914 South Main St. Est. $40,000. Noted Nov. 19.

Mass., Watertown—LAUNDRY—E. J. Sancomb, 33 Thaxter Rd., Newtonville, 1 story, irregular sized, concrete block, incl. boiler plant, concrete found., to O. Theurer, 171 Watertown St. Est. $40,000. Noted Nov. 12.

N. Y., Lowville—GAS PLANT—Johnson, Church & Co., engrs., 149 Bway., New York, gas plant, day labor and separate contracts for Lowville Gas Co. To exceed $50,000.

O., Cincinnati—BAKERY, etc.—Kroger Grocery & Baking Co., 35 East 7th St. (1st unit), bakery or food products distribution plant, to Parkway Constr. Co., Melish and Bathgate Sts. Total est. $200,000.

Pa., Warren—COMPRESSOR UNIT—United Refining Co., H. A. Logan, pres., rebuilding compressor plant, destroyed by fire, probably by day labor and separate contracts.

Wis., Kaukauna—PLANT—Thilmany Pulp & Paper Co., furnishing brick for remodeling 1 story, 80x216 ft. office-warehouse, and 43x280 ft. machine room addition, to C. Gmeiner & Sons, Waupaca; steel, to Worden Allen Co., Port Washington Rd., Milwaukee; roofing, to Federal Amer. Cement Tile Co., 608 South Dearborn St., Chicago, Ill.; sand and stone to Kaukauna Quarry Co.; cement to Kaukauna Lumber & Mfg. Co. Noted Nov. 12, under "Contracts Awarded."

GARAGES

PROPOSED WORK

Conn., New Haven—Auto Electric Sales & Serv. Co., Inc., 267 Park St., soon lets contract 1 story brick, steel service station, Goffe and Sperry Sts. $40,000. Brown & Von Beren, Temple St., archts.

N. J., Jersey City—J. Goldenberg, 80 Woodland Ave., revised sketches by C. Shilowitz, 26 Journal Sq., 15 story, basement, brick, steel, rein.-con. garage. $600,000. Noted June 12.

N. Y., New York—Domenico Sabattino, 1839 Sedgwick Ave., bids about April, general and separate contracts gas station and service garage, Sedgwick Ave. and 169th St. $45,000. DeRose & Cavalieri, 370 East 149th St., archts. Noted Nov. 19.

N. Y., New York—Five Hundred Fourteen West 23rd St. Corp., 100 Southern Blvd., will let general contract late in December, 4 story, 98 x 122 ft. garage and storage, 514 West 23rd St. $130,000. Bids in. R. G. Cory, 30 Church St., archt. Noted Oct. 22.

N. Y., Woodside—R. Stone, 39-33 Queens Blvd., Long Island City, sketches by C. Ungarleider, c/o owner, 111 x 222 ft. service garage, 51st St. and Queens Blvd. $40,000.

BIDS ASKED

N. J., Little Falls—F. W. Wentworth, archt., 140 Market St., Paterson, taking bids (selected list contractors) 2 story, basement, 140 x 280 ft., brick, steel, rein.-con. garage, Main St., for Little Falls Laundry Co., Main St. $150,000. O. E. Goldschmidt, 110 West 40th St., New York, engr. Noted Nov. 19.

N. Y., Maspeth—See "Contracts Awarded."

CONTRACTS AWARDED

N. Y., Maspeth—Realty Associates, 162 Rosen St., Brooklyn, 2 story, 100 x 200 ft. garage, by Maurice Ave. and 53rd St., separate contracts. $100,000.

SHOPS AND FOUNDRIES

PROPOSED WORK

Wis., Manitowoc—MACHINE SHOP—Manitowoc Co., A. W. Tetzloff, clk., machine shop $40,000 appropriated. Architect not appointed.

BIDS ASKED

Minn., Minneapolis—WATER METER SHOP —Dec. 15, by F. S. Gram, city purch. agt., story, basement, rein.-con., brick, 3rd St. between 2nd and 3rd Aves., for Waterworks Dept. $75,000. Noted Nov. 26.

POWER PLANTS

PROPOSED WORK

Ga., Augusta—Augusta Canal Comm., bids about February (1st unit) light and power plant, incl. five 3,000 hp. Diesel engines. $2,500,000 bonds voted for entire project. Burns & McDonnell Eng. Co., 406 Interstate Bldg., Kansas City, Mo., engrs. Noted Nov. 26.

Ia., West Bend—City Council power plant improvements, incl. 130 x 230 h.p. Diesel engine unit with alternate and direct connected exciter, engine not to exceed 360 r.p.m., completely installed; 90 kva. alternator and exciter for present 120 h.p. engine completely installed. A. C. switchboard complete installed converting present D.C. distribution system to A.C.; changing or furnishing new all motors, commercial appliances, household appliances-radios required for A.C. service. A Pertl, city clk.

Mo., St. Charles—City and W. S. O'Neal, mayor, retained Russell & Axon, engrs., Roosevelt Bldg., St. Louis, to conduct preliminary survey for municipal light and power plant. $200,000-$400,000. Noted May 7.

O., Galion — City, boiler room additions to municipal light and power plant. $175,000. Hadlow, Hughes, Hick & Conrad, Inc., 850 Euclid Ave., Cleveland, engrs.

Que., Jonquiers—City soon takes bids hydro-electric power house addition. $140,000.

BIDS ASKED

N. Y., Ossining—Dec. 17 (extended date), by Commissioner Correction, State Office Building, Albany, power house, knit shop, tunnels, heating and electrical connections Sing Sing Prison; adv. E. N.-R. Dec. 10. Noted Oct. 29.

CONTRACTS AWARDED

Mass., Palmer—Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, 1 story, brick, boiler house, plain found. at Monson State Hospital, to T. A. Cassidy, 43 Bolyston St., Fitchburg, $105,500; piping and equipment, to R. H. Baker Co., Inc., 218 Main St., Cambridge, $57,440. Noted Nov. 19.

Ontario—Abitibi Power & Paper Co., 88 University Ave., equipment, incl. relays, controls, disconnecting switches, circuit breakers, lighting arresters, station service transformers, 500 kw. station service unit in connection with hydro-electric development on Abitibi River at Abitibi Canyon, to Canadian General Electric Co. Ltd., 212 King St. W., Toronto. Noted Nov. 12.

WAREHOUSES

PROPOSED WORK

Md., Baltimore—American Stores Co., 2120 West Lafayette Ave., plans by A. B. Kister, 256 South Juniper St., Phila., Pa., warehouse addition. $130,000.

N. Y., Jamaica—W. Hurwitz & Sons, 92-25 160th St., plans by J. Fein, 1773 Pitkin Ave., Brooklyn, 3 story, 60 x 76 ft. manufacturing loft, storage, 160th St. and Jamaica Ave. $45,000.

N. Y., New York—Santini Holding Corp., 1337 Jerome Ave., bids about April, general contract 8 story, 50 x 120 ft. storage plant, Jerome Ave. and Clark Pl. To exceed $150,000. R. Gottlieb, 4756 3rd Ave., archt. Noted Nov. 19.

Que., Village of L'Enfant Jesus — Village Council, municipal brick, steel warehouse. $75,000.

BIDS ASKED

N. Y., Glendale—See "Contracts Awarded."

N. Y., Long Island City—See "Contracts Awarded."

CONTRACTS AWARDED

N. J., Newark—Lafayette Storage Co., 30 Liberty St., general contract altering and constructing 3 story, basement, 60 x 135 ft., brick, steel storage building, to Enstice Bros., 848 Broad St. Est. $150,000. Noted Nov. 26.

N. Y., Glendale—Asco Supply Co., 88th St. and Cooper Ave., 1 story, 100 x 166 ft. metal pipe storage sheds, 88th St. and Cooper Ave., by day labor and separate contracts.

N. Y., Long Island City—Queens Borough Gas & Electric Co., 160 Central Ave., 3 story work and service building, Beach Channel Dr. and West 108th St., day labor under supervision E. L. Phillips & Co., 50 Church St., New York, engrs. $60,000. Noted Nov. 26.

See proposal advertising on page 59